Popular Science

MONTHLY Founded 1872

December
1928
25 cents

New Ideas: Aviation - Radio - Automobiles - Home Building
Engineering - Exploration and The Home Workshop

Lights that lead to Homes

ORNAMENTAL street lights in residential districts attract homebuilders—substantial citizens who demand distinction in their surroundings—whose appreciation of beauty finds gratification in artistic design—to whom the decorative aspect of modern lighting is as desirable as its more practical advantages.

Where people still live on dimly lighted streets, modern illumination will endow the whole area with a new and better atmosphere, give residents just cause for pride, and increase the value of their homes.

Wherever houses are to be built, light is always the leader—and at the day's end it makes safe and cheery the ways that lead to the city's homes.

Street-lighting specialists of General Electric are always ready to coöperate with your power company in improving and extending your lighting system so that it may substantially contribute to the beauty, progress, and prestige of your city.

You will find this monogram on the huge turbines in power stations, on the improved lamps that light your streets, and on a score of appliances that save time and drudgery in the *completely* electrified home. The G-E monogram is your assurance of electrical correctness and reliability.

GENERAL ELECTRIC

Trustworthy Dealers Sell Trustworthy Used Cars

Unless you have a highly specialized knowledge of used cars and their values, you must rely completely upon the dealer to sell you a trustworthy used car.

The Cadillac Motor Car Company recommends Cadillac-La Salle dealers as reliable used car merchants because it has carefully pre-determined their fitness for endorsement. The Cadillac Motor Car Company assures you that you can buy any used automobile from your Cadillac-La Salle dealer with fullest confidence.

This company feels free to give this assurance because it knows that Cadillac-La Salle dealers so sell their used cars as to build good will.

CADILLAC MOTOR CAR COMPANY

Division of General Motors

Detroit - - - Michigan

WHAT IS NEW THIS MONTH

Table of Contents for December

LEADING ARTICLES

SPECIAL FEATURES

Automobiles

Aviation

Engineering

Exceptional People

December, 1928, Vol. 113, No. 6. Popular Science Monthly is published monthly at 250 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 26, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1928, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $3.50; foreign countries, $5. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. The use of Popular Science Monthly articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

Geology

Health and Hygiene

Laboratory Discoveries

Models

New Devices for the Home

New Processes and Inventions

Photography

Radio

Ships

Unusual Facts and Ideas

For the Home Owner

Hints for the Mechanic

Ideas for the Handy Man

$2,500 Interest from $10 a Month

$10 invested each month at 6½% with the interest re-invested at the same rate will accumulate $4,880.10 in 20 years. In these years you will have invested in cash only $2,400 and your earned interest will be $2,480.10—*more than the sum actually invested in cash.* Even at forty, if you invest $50 to $100 a month, you will be well-to-do by your sixtieth birthday.

6½% Compounded Semi-Annually

By systematically reinvesting the interest from your first bond, it will help to pay for another. Soon you will have interest on two bonds helping you pay for a third; interest on three bonds helping pay for a fourth, and so on. Can you think of a faster, surer method for the average man or woman to gain financial independence?

Send in your name and address on form below for free book, "How to Build an Independent Income."

USE THIS COUPON

The F. H. Smith Co

Investment Securities—Founded 1873

Smith Bldg., Washington, D. C.

285 Madison Ave., New York City

Branch offices in other Cities

NAME.....

ADDRESS.....M-12-28

MERGER PROFITS *for Your Money*

By Wallace Ames, *Financial Editor*

"WHAT'S one man's meat is another man's poison," remarked Harry Lyon, when he returned home from the monthly meeting of the Men's Club. "I just learned tonight that the Ethridges have sold their home on the Esplanade and are moving to a much more modest rented house on Second Avenue. The Winslows have bought the Ethridge home and are moving up the ladder from their little bungalow."

"What's it all about?" inquired Mrs. Lyon.

"Common stocks are responsible for both moves. It seems that Winslow bought the right ones and has made a lot of money; Ethridge bought the wrong ones and the blow is so severe that they've got to cut down on their scale of living."

"I'm sorry to hear of the Ethridge's hard luck," said Mrs. Lyon, "but it only helps prove my point that we should not invest our savings in common stocks as you have been figuring on doing. Let's stay on the safe side as we have in the past."

"You don't give me credit for having judgment, Laura. I certainly know as much as Winslow. There's big money to be made investing in common stocks. You can trust me not to make the mistakes that caused the Ethridge down-fall."

"Maybe so," concluded Mrs. Lyon, "but I'd rather trust safe investments than your judgment on risky ones."

II

"You are a bond man," said Harry Lyon, prefacing an inquiry he wanted to put to his friend, Graham Dickinson, as they joined for luncheon a few days later. "Maybe you can help me decide a point.

"The money I have been able to lay aside thus far has been invested in bonds and public utility preferred stock. There's a little over a thousand in our savings account now, most of which came from interest and dividends. I want to plunge to the extent of putting that money in some good common stock, not any fly-by-night proposition, but some solid company with a big future."

"THERE'S no denying that money has been made in common stocks," said Dickinson. "But for common stocks, and men willing to invest in them, America would never have become such a great industrial empire. Nevertheless. . . ."

"First let me tell you what I have in mind," interrupted Harry Lyon, "and then you can have the floor to present all your 'buts' and 'nevertheless.'

"I am planning to pick out a sound common stock, with real assets and real earning power behind it. You, yourself, have said more than once that a good common stock is better than a poor bond. There are common stocks in the investment class, just as there are speculative bonds.

"This is the age of consolidations. I've noticed, time and again, that when companies merge the strength of their organizations, the stocks of the merged companies earn more money and become more valuable. That is my point number one.

"Recalling how many small automobile manufacturers have been absorbed or merged with larger ones, and noticing that the radio business is developing even more rapidly than the motor car business did during its first few years, it seems to me that we can expect to have a lot of radio mergers in the years ahead. That's my point number two.

"Putting number one and number two together, I believe it would be a good idea to invest in the common stock of one of the stronger radio companies. Later on I might get some of the profits of a merger, in addition to my regular dividends. What, in your opinion, is the best radio common stock?"

"There is some logic to your reasoning, Harry," resumed Graham Dickinson, "but your hunch is just as good as mine as to which stock to buy. I see what you are after, though, and I believe I can satisfy you and still keep you from speculating.

III

"Why don't you do a little merging yourself, instead of trying to pick the one stock out of many which you hope may form a consolidation profitable to the shareholders?"

"Now you are beginning to pipe-dream worse than I ever did," accused Harry. "I'm a 'thousandaire,' not a millionaire; I'm a printing salesman, not a promoter. Where do you get this merger idea for me?"

"When I mentioned merging, I meant it seriously," assured Graham. "Merge your $1,000 with the hundreds, the thousands and the ten thousands possessed by others like yourself. Put your money in the shares of an investment trust. Get the advantage of skilled selection of securities and careful supervision of them provided by investment trust managers. Your chances of accomplishing what you have in mind are many times greater through an investment trust because you gain for your $1,000 the advantages and facilities that resources, mounting into the millions, can give."

"Sounds interesting," said Harry. "Tell me the rest of the story."

"An investment trust is a merger of investment capital," continued Graham. "The economic reason for the investment trust is much the same as the reason for any other merger, a public utility merger, for example. A group of small utilities unite into one large company because by so doing they can operate more economically, command greater talent and give better service than each small company can individually. The same thing is true of an investment trust. When you and I and a lot of other persons, each with a little money put our funds into investment trust shares, together we create large resources. Then, just like an insurance company or big bank, we have the power to do things that none of us can do individually.

"In the first place, an investment trust that has several millions in resources can buy several hundred securities, not just a few. The law of average then gets to work for every shareholder. Out of several hundred carefully chosen securities, some are likely to prove extremely profitable.

"In the second place, by spreading the expense of management over a large investment fund, talent and facilities can be secured economically that you or I as individuals could never afford. An investment trust can command the best of statistical facilities and the best of managing talent to use those facilities. It employs men who devote all their time to the study of securities and business conditions. It selects securities on

(Continued on page 8)

Merger Profits for Your Money

(Continued from page 4)

facts, not hunches. You, as a shareholder, get the benefit of skilled management otherwise entirely beyond your reach.

"Most investment trusts place a portion of their funds in common stocks. It is safer for the trust to invest in common stocks than for you or I to do so. The trust's risk is greatly reduced by ownership of many different securities and further by the fact that, while some of its money is in common stocks, it also invests heavily in bonds and preferred stocks.

"In other words, the sting of risk is pretty well taken out of the investment trust's common stock holdings and all the profit possibilities remain. Of course you need not expect to become a millionaire if you buy a few investment trust shares. You must bear in mind that perhaps not more than 1% of the trust's resources are in one security. Therefore, even if one company, whose common stock it held, declares a 100% extra dividend such a dividend is equal to only 1% of the total invested resources of the trust.

"The investment trust whose stock I would recommend to you has been operating several years and has averaged over 10% in gross earnings since it was first organized. That's not quite getting rich over night, but over a period of time the shareholders in that trust ought to do very well, certainly a lot better than you would likely do with your plan of random investing."

IV

"This check is on me," said Harry, as the waiter approached. "And I owe you a lot more than this lunch in return for your advice. When I tell Mrs. Lyon that I am going into a merger, and explain it all just as you have explained it to me, she will be mighty pleased and not a little relieved. She never was in favor of my common stock idea. Your investment trust idea will just suit her."

To Help You Get Ahead

THE Booklets listed below will help every family in laying out a financial plan. They will be sent on request.

"Ideal Investments" is the designation universally accorded Smith First Mortgage 6½% Bonds which carry attractive tax refund features. A history of the House and information relative to their bonds and the safeguards that surround every issue they offer may be obtained by addressing the home office of The F. H. Smith Company, Smith Building, Washington, D. C.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the banker who offers it. Address: Fidelity Bond & Mortgage Co., 1188 New York Life Building, Chicago, Ill.

"The Investment Trust from the Investor's Viewpoint," presents an explanation of this form of investment in easily understood terms, illustrated with some interesting examples of how the general investment trust will help the man with $100 or more to get ahead. Published for free distribution by United States Fiscal Corporation, 50 Broadway, New York. Ask them for Booklet IT.

How to Retire in Fifteen Years is the story of a safe, sure and definite method of establishing an estate and building an independent income which will support you the rest of your life on the basis of your present living budget. Write for the booklet to Cochran & McCluer Company, 46 North Dearborn St., Chicago, Ill.

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting (Continued on page 6)

You can laugh at money worries

if you follow this simple financial plan

YOU'RE interested in having the best possible time while you live—with the least worry and grind and discomfort.

You don't want to pay rent all your life—you hope to own your own home some day. And you don't get any thrill out of the idea of appearing at an office or a mill or a store at the same old hour every morning until you die.

You want to quit work sometime. And when you do quit you want to feel that you're *justified* in quitting—that you've earned it. You want to know that your wife and children will be taken care of, no matter what happens to you.

You can accomplish every one of these things—just by following a simple financial plan.

How it works

This simple system of investment plus protection was devised by financial experts. It calls merely for the deposit of a few dollars each month—the exact amount depending on your age and the things you wish to accomplish.

The minute you make your first small deposit you actually create an estate of $10,000 or more. This money comes to you when you are 60 or 65. And if you should not reach that age, it goes to your family.

A few of the things you can provide for by this plan are as follows: —money to send your children to college—money for emergencies—money to live on in case you are permanently disabled—capital to start your son in business—money to pay off a mortgage—an assured income for your family, no matter what happens to you.

Don't you want these things? You can have them.

The coupon at the bottom of this page will bring to you, free, the Phoenix Mutual "Prosperity Plan."

Sending for it is the first step towards real independence—protection for you and your family, no matter what happens—an education and every advantage for your children—leisure and comfort for yourself in later years.

There's no obligation. Send for your copy *now*.

Plan sent free

PHOENIX MUTUAL LIFE INSURANCE COMPANY

Home Office: Hartford, Conn. . . First Policy Issued 1851

HERE are just a few of the things you can do under the Phoenix Mutual Plan:

1 Retire with an income when you are 60 or 65.
2 Leave your home free of debt.
3 Send your children to college.
4 Create an estate.
5 Make sure your income will go on even though you become totally disabled.
6 Leave an income for your family.

PHOENIX MUTUAL LIFE INSURANCE CO.
288 Elm Street, Hartford, Conn.

Send me by mail, without obligation, my copy of your "PROSPERITY PLAN"

Name_____
Business Address_____
Home Address_____
City_____ State_____
Date of Birth_____

Will History Repeat?

Early in 1925 investors were offered the opportunity to purchase shares in Financial Investing Co. of New York, Ltd., a general investment trust under management of United States Fiscal Corporation.

Between April, 1925, and April, 1928, an investment of $1550 in 100 shares returned a cash profit of $470 and the investor could have sold his stock at a market profit of $875—*a total three-year profit of $1345 on $1550 invested.*

Two Dividend Increases Plus Extras

The initial dividend rate of 10% was increased to 12% July 1, 1927, and to 16% July 2, 1928. Six extra cash dividends have also been paid, making total payments on the $10 par value shares as follows:

Year Ended	Regular	Extra	Total	Current Price of Shares
April 1, 1926 . . .	10%	2%	12%	$12.50
April 1, 1927 . . .	10%	3%	13%	20.00
April 1, 1928 . . .	12%	2%	14%	26.25
July 2, 1928 (3 mos.)	4%	(annual rate 16%)		28.25

You May Now Invest In SECOND FINANCIAL INVESTING CORPORATION

All the shares of Financial Investing Co. of New York, Ltd., having been sold at prices increasing from $15 to $28.25 per share, United States Fiscal Corporation now offers you shares in Second Financial Investing Corporation.

Since these two investment trusts are under the same management and alike in major particulars, it is anticipated that history will repeat itself, the new trust duplicate the success of the old and pay similar profits to shareholders.

You now have the opportunity to become an original stockholder — to invest $100, $500 or any larger amount in Second Financial Investing Corporation before any substantial increase in price occurs.

Learn How to Make Big Profits Conservatively

It is all explained in our booklet, "The Investment Trust—from the Investor's Viewpoint," and in literature describing Second Financial Investing Corporation. Mail the coupon and profit by reading this free literature.

UNITED STATES FISCAL CORPORATION

Managers of

Second Financial Investing Corporation

and

Financial Investing Co. of New York, Ltd.

United States Fiscal Corporation
50 Broadway, New York

Please send me, immediately, your free booklet that tells how I can invest for financial independence.

Name .....

Address .....

To Help You Get Ahead

(Continued from page 5)

ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

The Guaranteed Way to Financial Independence tells how a definite monthly savings plan will bring you financial independence. Write for this booklet to Investors Syndicate, 100 North Seventh Street, Minneapolis, Minn.

The Making of a Good Investment tells how 6½% can be made on investment in First Mortgage Bonds in units of $50, $100, $150, $500 and $1000; how the bonds are protected and how simple it is to purchase them. For a copy of this booklet address United States Mortgage Bond Company, Limited, Detroit, Michigan.

Here is the ANSWER

to questions which bother many investors

How can you tell what gives a first mortgage bond absolute safety?
How can you get the highest income from your money, consistent with safety?
How can you select a safe investment house?
How can you retire in 15 years on your present living budget?
How can you get double the savings bank interest rate or more, with all the convenience?
How can you judge the security back of a first mortgage bond?
What is the history of the first mortgage bond in Chicago?
Why can Cochran & McCluer sell first mortgage bonds in every state of the Union without salesmen?

All of these questions and many others vital to investors are answered in the new edition of a famous book, "Behind the Scenes Where Bonds Are Made." Get your copy now. We'll gladly send it. No salesman will call.

P.S.M. 12-28

Cochran & McCluer Co.
46 North Dearborn St.
Chicago, Ill.

Gentlemen: Please send me without obligation your book, "Behind the Scenes Where Bonds Are Made." No salesman will call.

Name _____

Address _____

City _____ *State* _____

Cochran & McCluer Co.

Established 1881
Never a loss to any investor
46 NORTH DEARBORN STREET
Chicago

This Christmas— Give a Bond

Money is made to be spent. Usually a gift of money melts away with the snows. But, a bond is so evidently made to be saved that it is cherished long after other gifts are forgotten. In addition, a bond perpetuates your gift in the form of interest coupons.

Fidelity First Mortgage 6% Real Estate Bonds in denominations of from $100 up, form ideal Christmas gifts in that they combine Safety with high rate of yield.

You will be interested in the booklet, "The Home Behind the Bonds", which will be sent upon request, together with a list of our latest issues.

FIDELITY BOND & MORTGAGE CO.

650 Chemical Bldg., St. Louis
1168 New York Life Bldg., Chicago
378 Colorado Nat'l Bank Bldg., Denver

"FIDELITY GUARANTEES EVERY BOND"

BUILD an Income Step by Step

WHILE for years a favorite among large investors, United First Mortgage Bonds are likewise available to the small investor who prefers to buy on partial payments. Only a small initial payment is needed to start you on a sound investment program.

United First Mortgage Bonds pay 6% and the payment of interest and principal is guaranteed by the oldest exclusive first mortgage bond company in Michigan.

Mail coupon today for copy of booklet, "Plant an Acorn", and complete information regarding easy purchase by mail.

United States Mortgage Bond Company

Howard C. Wade, President
365 U. S. Mortgage Bldg., Detroit
Reserves more than $19,000,000

6% GUARANTEED UNITED FIRST MORTGAGE BONDS

In Canada: United Bond Co., Ltd., Toronto and Windsor, Ont.

MAIL THIS COUPON TODAY

United States Mortgage Bond Co.
365 U. S. Mortgage Bldg., Detroit, Michigan
Please mail copy of booklet, "Plant an Acorn".

Name _____

Address _____

City _____ State _____

CABINETS BY
Berkey & Gay

Start with the chassis: it's the basis of radio value.

How you can buy Radio engineered like a Fine Car — *at a moderate price*

Balkite A-5 — *The Table Model. Walnut cabinet, by Berkey & Gay, the most distinguished furniture house in America.*

Balkite A-3 — *The same chassis, housed in a simple, but sightly, all-metal case.*

$125.00 *to* $950.00
Less tubes

As everybody knows, the Balkite AC receiver gives you the same marvellous quality of reception that you find in the most recent laboratory mechanisms of today.

Engineering refinement is the answer. Engineering refinement made possible this great forward step in radio. In fact, nothing short of this can give you the daily quality of service wanted in radio; service comparable to that of a fine car!

Now here is a way to buy this "engineered" radio at a moderate price. If music is what you want and all you want, buy the Balkite chassis housed in a simple but sightly all metal container. If you want music plus furniture, buy this same unit—and then choose the cabinet that fits your purse, your preference or your decorative scheme.

The Fansteel dealer has a wide variety of cabinets to show you—among them the cabinet you want at the price you want to pay. Ask him!

This is the logical way to buy radio—the way to buy radio engineered like a fine car—at a moderate price!

Fansteel Products Company, Inc., North Chicago, Ill.

FANSTEEL
Balkite Radio

Copyrighted material

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Choosing the Right Radio Set

By
F. G. PRYOR
Secretary
Popular Science Institute of Standards

THE man who is buying a radio today has wonderful opportunities before him—and some pitfalls as well. Never were there so many fine radio outfits on the market, and never were so many sets found below par by the Popular Science Institute of Standards' tests.

The 1928–29 radio market offers you sets that far exceed, in tone fidelity and in volume, those offered in previous years. Likewise, some improvement over earlier sets is found in selectivity and sensitivity to distance reception. The really big advance, however, has been in tone and volume.

Current receivers also possess new advantages in the way of convenience and appearance. With the elimination of battery equipment and the substitution of the electric light socket as the source of power supply, inconvenience and unsightliness are done away with. Today, you can get attractive table models with separate loudspeaker, or consoles with built-in loudspeaker, and in neither case are outside accessories necessary.

The radio buyer's problem, then, comes down to this: He must be sure to select from among sets that come up to 1928–29 standards of efficiency and value, and he must be equally sure he is buying the qualities he wants most. In this, Popular Science Institute can be of assistance. It has completed tests of most of the leading radio outfits, and has prepared a list of those makes that can be considered reliable. The basis for listing has been exacting laboratory tests involving fidelity of reproduction, selectivity, sensitivity to distance reception, power-handling ability, and simplicity of control. In addition, to merit approval, a set must be so designed and constructed, both electrically and mechanically, to insure reasonable freedom from breakdown and necessity for servicing.

The final selection of an outfit suited to the buyer's special requirements, however, must necessarily be left to the buyer himself. But here again the Popular Science Institute will be glad to help to the extent of making specific recommendations, when full information is given as to just what is wanted and how much is to be invested.

"How much must I spend today to get a really good set?" is a question frequently asked. Of course, the term "really good" means one thing to one person and something quite different to another, but we cite as a price indication the fact that the cheapest electric set on the Popular Science Institute's approved list, at this writing, costs $80 without tubes and speaker. This in no way indicates that cheaper electric sets are not worth purchasing, but it does give a clue as to the approximate low price level at which good electric sets can be manufactured and sold under ordinary conditions.

No matter how much money one is investing, the essential thing is to see that the full amount goes for those qualities the buyer wants most. The sets in which all qualities are developed to a high degree cost several hundred dollars to manufacture. It might seem that in cheaper sets all qualities would be evenly developed to a degree consistent with the price. The Institute's tests, however, indicate that such is not the case. A set may excel in tone quality, for instance, and in other features barely make the grade for its price class.

THIS makes it possible for the radio buyer to pay only for those features he prefers. If you live in a metropolitan area near the good broadcasting stations, for example, there is no particular advantage in a set that is very sensitive to distance reception; rather concentrate on selectivity and tone fidelity in the set you choose. Likewise, if tone quality is the thing you most desire, select the set that is particularly fine in this regard, and be willing to sacrifice less desired features if your investment is limited.

In buying, then, investigate with the above points in mind. Listen to as many sets in friends' homes and dealers' stores as possible. An investment in a radio outfit which has been approved for price and performance by the Popular Science Institute, and which particularly excels in the qualities you consider most important, will bring you the maximum of radio pleasure.

* * *

INSTITUTE BULLETINS

List of Approved Radio Products, free on request. *What the Radio Buyer Should Know*, a twenty-two-page booklet full of helpful advice, price twenty-five cents. Address Popular Science Institute, 250 Fourth Ave., New York, N. Y.

Popular Science Monthly
GUARANTEE

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly.

The Publishers

Industry after industry discovering new uses for this *grainless* wood board

Read the story of its wide and steadily increasing uses. Read about its remarkable workability, uniform strength, high resistance to moisture, and many other advantages. Then send for large, free sample of Masonite Presdwood, and put it to the test yourself.

FOR STORE FIXTURES

Here is a product which is writing a new page of progress, and in scores of industries meeting challenge after challenge of modern manufacturing.

Think of it!—genuine wood board that is absolutely grainless! A board that will not crack, check, split or splinter! A board of uniform strength and truly remarkable workability!

And yet these are only a few of many advantages of Masonite Presdwood. It is very dense and tough. It cannot be destroyed by moisture. One face is steel furniture finish for smoothness and the other side has an imitation canvas finish. It requires no paint for protection, and also takes any finish beautifully.

Presdwood is simply wood torn apart, and put together again. It contains no foreign substances of any kind; not even a chemical binder. So it cannot damage tools.

Presdwood comes trimmed to a four-foot by twelve-foot size. It can be used on any woodworking machine; saw, planer, sander, shaper. It can be cut out, punched, die cut and shaped. In fact, you will find that Presdwood is adaptable and workable almost beyond belief.

No limit to its uses

There seems to be practically no limit to the uses for Masonite Presdwood, and new uses are being discovered week after week.

Candy manufacturers are now using Presdwood for starch trays, and in a number of large manufacturing plants all the telephone booths are lined with it.

In the Chicago Art Institute it is backing and permanently protecting rare works of art.

The ceilings in the new Pullman Cars of various railroads are made of Presdwood; so is flooring for dance halls and pavilions.

FOR PANELING

Packing cases, concrete forms, radio cabinets, incubators and bowling alleys—these too, are being made of Masonite Presdwood.

And store fixtures of all kinds, bedroom screens, invalid trays, shelving, work-bench tops, table tops, clothes hampers, bread boxes, cupboards, breakfast nooks and china closets!

Campers' tables, automobile bodies, safety wheels for bathing beaches, speed boats, highway signs and entrance signs, all these too, are made of Presdwood!

Send for free sample

Write for a large, free sample of Masonite Presdwood, and find out what it will do for you. It may be the very material for which you have long been looking. It may enable you to make a worthwhile improvement in your product, and at the same time lower your operating costs to a marked degree. Try Presdwood for yourself!

MASONITE CORPORATION

Sales Offices: Dept. 1212, 111 W. Washington St. Chicago, Illinois

FOR PLAYHOUSES AND TOYS

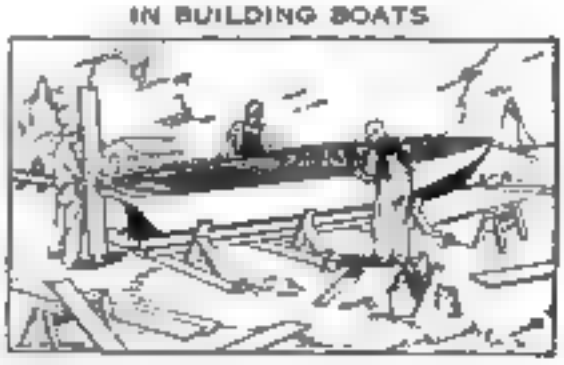
Mills, Laurel, Mississippi

Masonite PRESDWOOD

Made by the makers of

MASONITE STRUCTURAL INSULATION

IN BUILDING BOATS



© 1928, M. P. Co.

Our Readers Say—

A High Hat? Never!

"I SEE your last issue was all prettied up in the middle. First it was fiction, then an editorial page blossomed forth and now it's a rotogravure section. What next? Old Methuselah duded up with silk topper and spats?

"Why not stick to plain, unvarnished science? Yourmans, your founder, did it. I am old enough to remember that fifty years ago Popular Science Monthly needed no 'dolling up' to world power in the world of science. Naked truth needs no paint to set off her charms.—A. N. P., Philadelphia, Pa.

Forever, We Hope

"I HAVE been a subscriber for two years, and would like to ask how long do you think you can continue making the next issue just a little better than the last one? I even read every advertisement."—L. S., Rockford, Ill.

The Lid Blows Off

"THAT person who signed himself 'Veteran Home Workshopper' ought to be ashamed to admit that he is as unprogressive as his letter seems to imply. Lambasting the modernistic furniture, he inquires: 'Have we become such slaves to raw efficiency that we must give up all sense of beauty and proportion?'

"Have we become such slaves to raw efficiency that we must use automobiles, telephones, radio, etc.? Will he please tell me why a person should step out of a luxurious car, train, ocean liner or airplane and live in a house filled with furniture designed when Queen Anne, Queen Elizabeth, or Louis XIV was living? If he will go into the matter of furniture design a little deeper, he will find it has always followed the same lines as architecture; therefore, when we live in this day of speed and efficiency, why not have our furniture in keeping with the times?

"As you stated, the pieces shown in your magazine were of the simplest kind. If the gentleman had gone to any of the recent exhibits of modernistic styles he would have seen pieces that would have made Chippendale turn green with envy."—Le Moderne, New York City.

That Tinkling Glass

"THE letter of R. G. D. of Baltimore told of noticing that the tinkling tone made by floating ice against a glass of carbonated beverage rises in pitch if the glass is shaken rapidly. I think this rise in pitch is due to the lowering of the temperature of the glass as the ice melts in the beverage, and not to the carbon dioxide bubbles, as he believes. I have noted the same results with acid hypo and magnesium sulphate. They both lower the temperature of the water as they go into solution, and neither are effervescent.

"Exactly the opposite is noted when the liquid is warmed, as when muriatic acid is 'cut' with zinc. The chemical action on the zinc as it goes into solution beats the liquid and the sound given out by the glass will gradually become lower in tone as the temperature rises."—H. L. B., Lodi, Tex.

See Page Fifty-Two

"I READ with interest your article telling how the Popular Science Institute of Standards tested the so-called buried antenna and found it to be worthless. I am glad to see these gyps exposed to the public. Now I would like to see the gyp exposed that sells the 'ball antenna.' This is as big a fraud as the buried antenna."—J. B., Bloomington, Ind.

Back at the Byrd Shooters

"SUFFERING catfish! I didn't think any person could hate and be so jealous as that person who signs 'L. L. C.' to a letter berating 'Dick' Byrd. If L. L. C. will get busy and use his intelligence in a constructive manner and do some outstanding thing, I'll take my hat off to him just as quickly as I did to Lindy and Dick Byrd."—J. C. L., Santa Barbara, Calif.

"If Byrd makes his flights, as L. L. C. claims, for the 'fat profits,' then why doesn't he keep them instead of putting them into another expedition in which he is very liable to be killed?—D. E. C., Washington, D. C.

Byrd has too wonderful a record so far to make any talk of him stirring up ballyhoo and hero-worship true. Probably L. L. C. will live to see the day when airplanes are as numerous as automobiles, and I hope it comes soon.—W. K. C., Haddon Heights, N. J.

L. L. C. seems to think that as he can see no good result from Byrd's flights they are the bunk. But who saw more than a toy in the original motion picture machine?—F. C. H., Columbia, Mo.

"I was dumbfounded to think that anybody could be so narrow-minded, ignorant, and pig-headed as to believe that Byrd ever attempted a polar or an ocean flight for his own personal interests."—P. M. J., Melrose, Mass.

Building 'Em in India

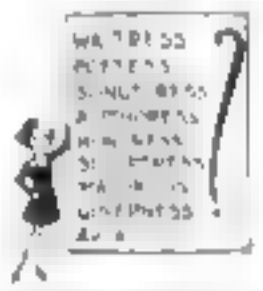
"I AM one of your numerous subscribers in India and take great pleasure in ranking, with the help of my younger brothers, many of the small but useful articles described in your 'Home Workshop' columns. Let me hasten to assure you that this taste of making things with our own hands we owe entirely to your magazine. Our latest venture was to make the model airplane, *Spirit of St. Louis*, described in your pages. It is so very realistic that everyone who sees it praises us for our skill and perseverance. It was a sheer delight to us as the thing took shape day by day and as each successive construction problem was overcome.—W. D. B., Cracklock-Town, Nagpur, India.

How Do You Shovel?

"IN THE carpenter gang where I work, a dispute has been standing unsettled for some time. About half of the men, when they shovel, hold the handle of the shovel on their right side. On the strength of that they contend they are shoveling right-handed. The others hold the shovel on the left side. They maintain that since the right hand does the lifting, they are shoveling right-handed. I would like to have your opinion as to which is the right handed way of shoveling.—A. H., San Diego, Calif.

We put this up to the members of our editorial staff. The majority, who are naturally right-handed, hold the shovel at the right side, but one who is otherwise right-handed holds it at his left side, while another, who is left handed holds it at his right side. So the question has not been settled, as the judge would say, "beyond a reasonable doubt." What is your opinion?

Why Not "Piloteus"?



"REFERRING to Amelia Earhart, you call her a '30-year-old aviatrix.' I stand ready to inform you that the word 'aviatrix' has been stricken from the flyer's vocabulary. Certainly you do not differentiate between the sexes in regards to the driver of an automobile, then why so in plane?

"The National Advisory Committee for Aeronautics defines the term aviator as 'the operator, or pilot, of heavier-than-air craft. This term applies regardless of sex of the operator.' The word 'aviatrix' was removed about three years ago."—H. W., Berkeley, Calif.

No Human Speed Limit?

"CONCERNING your editorial answer to a reader, as to what is the maximum speed the human body will stand, note that, due to the rotation of the earth, a man standing at the equator is traveling a little more than 1,000 miles per hour; the movement of the earth, in its orbit around the sun, as we recall it, is several times this figure, etc.

"There does not seem to be any physical limit to the speed the human body will stand. There is a limit as to what acceleration the body will survive, but this limit must be in excess of 3*g* (three times the acceleration of gravity), or about sixty miles per hour per second, which is the rate used by the Navy in its airplane catapult."—H. F. B., New York City.

Too Useful to Miss

"STRANGE to say, I discovered only the other day how useful your complete classified index in the front of the magazine is. I was surprised how much it helps me to find at once the articles in which I am particularly interested."—A. D. B., Brooklyn, N. Y.

NEW

THE 50 BOX of Gillette Blades

EVERY TIME HE SHAVES IN 1929 HE'LL THANK YOU

A SMART, masculine gift box that's bound to be appreciated all over again each morning! Generous measure for generous shaving comfort! Not a short-lived present, not a frivolous one, but a soundly sensible, month-after-month gift that appeals to a man's practical nature.

And the distinctive thing about it is its newness....it is presented by Gillette for the *first time* this Christmas. You can be sure when you choose the Fifty Box for him that he has never before received a similar gift for Christmas—or any other time.

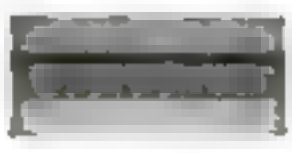
P. S.—When empty, this strongly-built little chest makes an ideal cigarette box for your desk. Or use it for stamps. Or even on your dresser for collar buttons. Its usefulness is varied and its life is long.

Brand new!

Fifty of the famous double edged Gillette Blades (one hundred shaving edges) tucked away in a sturdy, compact, colorful box. An original, personal way to carry your season's greetings far into the New Year.

$5 everywhere

The perfect gift



GILLETTE SAFETY RAZOR CO., BOSTON, U. S. A.

"... there came wise men from the East to Jerusalem ... and they presented unto Him gifts, gold, frankincense and myrrh."

It is our sincere hope that the gifts you make this Christmas may bring to the little worlds into which they go, something of the joy and happiness that the greatest gift of all time has brought to humanity.

A. H. Grebe & Co., Inc.

GREBE SYNCHROPHASE A-C Six RADIO

A. H. Grebe & Company, Inc., 109 West 57th Street, New York City

Factory: Richmond Hill, N. Y. *Western Branch:* 443 So. San Pedro Street, Los Angeles, California

Makers of quality radio since 1909

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Popular Science Monthly

DECEMBER, 1928 SUMNER BLOSSOM *Editor* VOL. 113, NO. 6

Windmill Plane Makes Good

Latest model autogiro in flight, carrying the inventor pilot and a passenger. "A cross between a windmill and a dragon-fly."

The young Spanish inventor of the revolutionary aircraft, Juan de la Cierva. He plans to bring the machine to America

Cross-Channel Flight of the Autogiro, Latest in Aircraft, May Bring a Safer Era in Aviation—Its Young Inventor Tells How It Works and What It Does

By MARCEL WALLENSTEIN

LIKE a leaf drifting gently to the ground, a flying windmill dropped out of the sky, the other day, and onto the aviation field at Le Bourget, near Paris. Aviators and mechanics, the usual crowd at the busy airport, watched it descend—a strange craft with the body of an airplane and four great windmill-like vanes slowly spinning above it in lieu of wings. Gracefully it floated to earth, rolled a few feet, and stopped. Two men stepped out.

This was the "autogiro," so-called freak plane of the Spanish inventor Juan de la Cierva, designed to land in the space of a few square yards. It had proved itself. With the inventor-pilot and a passenger it had crossed the English Channel from Croydon, the London airport, to St. Inglevert, a small field near Boulogne, France—a hundred-mile flight on the London-Paris airline—then on to Paris. It had, in the opinion of several European experts, unlocked a door leading to new conquests of the air.

Shortly after the Channel-crossing the autogiro, repaired following an unfortunate mishap and crash during an exhibition flight, made another successful flight, this time from Le Bourget field to Brussels, the Belgian capital. And as this is written, the young Spanish inventor has announced his intention of bringing the strange craft to America soon.

Lindbergh and those who followed him flew across the Atlantic airlanes and were hailed as heroes. The mere channel flight of Cierva is in itself a modest feat in comparison, but it has proved to the world that the autogiro is a practical advance in flying, perhaps the greatest forward stride since the Wright brothers taught the world the rudiments of aviation.

For nearly five years Cierva had been demonstrating a succession of models of his autogiro in Europe. To all save a few isolated enthusiasts, the invention had been regarded as a freak, an amusing experiment, but not a safe solution of the most difficult problem in aviation which it was designed to meet—landing at a dead stop. But the success of the Channel flight at once caught the public imagination. Here was a machine which at least could stay in the air, could do its hundred miles an hour, could cross the twenty-one miles of water dividing Britain from the Continent.

"The most important flight since Bleriot first flew the Channel" is the opinion generally of the British experts. The British Air Ministry has ordered four machines from Cierva, and the French government is contemplating immediate purchases.

HAS a new epoch dawned in aviation? Possibly. Inventors long have dreamed of air travel for everybody; of the traffic problem solved in the sky; of planes rising vertically from and descending upon flat-top roofs. The autogiro by no means brings all this to pass; yet it does offer a concrete, tangible development in that direction. Those who have looked toward the day of the helicopter—the flying machine capable of lifting itself

straight up—may now concentrate their attention upon the invention of the young Spanish engineer, and the subsequent perfection of it. Not a helicopter is his device, but an airplane so radically modified as to give remarkable qualities of stability, safety, and ability to rise and descend in the most cramped flying fields. Even twenty passenger, 250-mile-an-hour autogiros may be built, the inventor declares.

The story of the autogiro is a story of intelligence and hard work. Young De la Cierva's efforts have not been those of a penniless youth fighting upwards from obscurity. His father is a prominent and wealthy Spanish lawyer, who, in the government preceding the dictatorship of Primo de Rivera, was war minister in the Madrid cabinet

AT THE age of sixteen Juan Junior turned his attention to aerodynamics, although his first experiments were not with the windmill plane. The theory of the helicopter first interested, then commanded his efforts, and this interest led directly to the development of his revolutionary plane.

"In 1920 I had the first theoretical conception of my autogiro," he told me in London just after his Channel flight. "Three years later I actually showed one of my machines in flight. Two years later I had improved greatly on the original idea with the machine I brought to England."

He was invited to demonstrate his plane in England, where Sir Sefton Brancker, vice air marshal, a student of flying since long before the war, gave him every assistance. In De la Cierva's three years of experiment in the face of public and official apathy, Brancker has been his constant friend and counselor.

Prior to his arrival in England De la Cierva had spent only about two hours in the air in his autogiro.

"In 1925," he told me, "I was trying only to prove that the machine would fly and that it had one or two essentially new qualities. Now that the 'flying windmill' has proved it can fly, my task has been to produce machines as perfect mechanically as standard airplanes, comparing with them favorably in ordinary performance, and possessing, besides, the new advantages which ordinary planes cannot hope to attain."

BEFORE the Channel flight, De la Cierva had put in about forty hours of experimental flight over various parts of the United Kingdom. At aerial meets, all through the spring and summer, the horizontal windmill blades of his craft became familiar to thousands of spectators. Three British service pilots, including Bert Hinkler, the famous Australian, have put the new model autogiro through severe tests at the Hamble airdrome near Southampton. A. V. Roe & Company, the pioneers of British aircraft construction, now are turning out the craft for the inventor's company, which is known as Autogiro Limited. It is reported to have sold nine autogiro planes already—

Wherever the autogiro has crashed, its easy vertical drop has prevented serious or fatal accident. This picture shows the machine after its recent crash at Le Bourget Field. De la Cierva and a passenger escaped injury.

of which one is for use in the United States, another purchased by Italy, three by Spain, and the other four by England.

Cierva emphasizes the fact that his "autogiro" is not a true vertical flying craft despite some popular impression to the contrary. It is essentially an airplane, but an airplane at which you will look in vain for wings. Only the appendages of wings remain on long poles—a lonesome pair of ailerons, or balancing flaps. Above, on a mast whirl the feather-shaped windmill vanes, slowly or swiftly as the airplane's speed changes.

In these spinning vanes lies the whole secret of the autogiro's ability to come to earth at the amazingly slow speed of fifteen miles an hour, as it did at Le Bourget, instead of the forty or more required by a standard plane. This slow

Cierva in the cockpit at the start of the Channel flight, showing upright rotor mast, and the hinged joints of the lifting vanes

descent minimizes the chance of a crack-up.

The vanes are perfectly free to spin—not by motor power, but by the forceful air draft created by the airplane's own forward speed under its standard tractor propeller. As they spin on their ball bearings they lift.

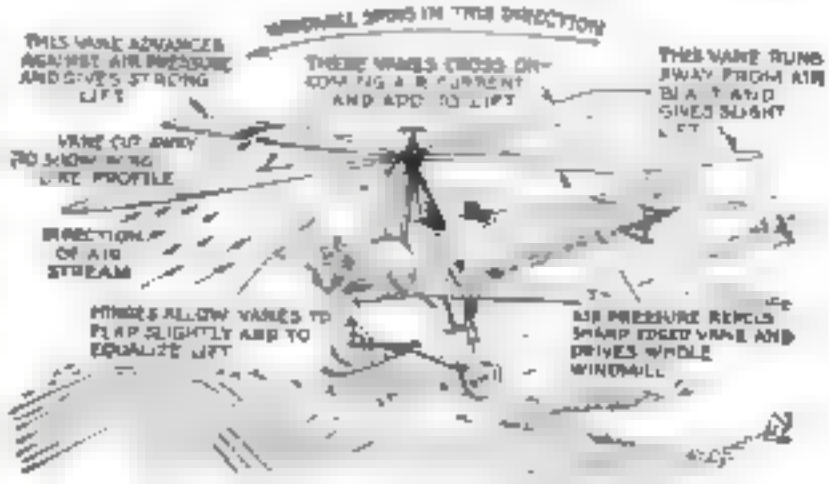
Consequently, although the airplane may be moving at the leisurely rate of fifteen miles an hour, the sustaining air stream that lifts the windmill-like wings, and through them the plane, is moving for practical purposes much faster—the plane's speed, plus a certain speed due to the vanes' own spinning. Hence the autogiro can stay in the air or float deliberately to earth, where a standard plane, robbed of its sustaining velocity, would drop like a plummet and crash.

THAT is the autogiro principle in a few words. In practice, it is a little more detailed. How can the windmill, so-called, spin at all when the air stream strikes both sides? Because of the fact that the wings of the windmill are streamlined, and such streamlined bodies offer more resistance to the wind with their sharp edges forward than reversed. And De la Cierva demonstrated with a model, in the aerodynamic laboratory of Cuatro-Vientes at Madrid, that the excess wind pressure on the sharp-edged side of his windmill, as illustrated in the diagram accompanying this article, is sufficient to whirl the whole thing.

This diagram, too, shows why the total lift of the windmill is greater than for a stationary wing. One inclined windmill vane is moving forward against the air with its own spinning speed plus that of the plane; therefore, its lift is greater than that of a stationary plane. The opposite vane is running away from the plane's motion; its lift is less. But there are also two vanes fore and aft, whose lift is a combination of their own speed and some air pressure caused by their inclined position with respect to the plane's travel, hence the sum of all four is a lift considerably more than could be obtained with a conventional wing of the same total area.

SINCE a vane on one side lifts more than the opposite one, why doesn't the autogiro tip over sideways? Because the unequal lifts are equalized through hinges on the shaft that allow the vanes, which are hung on elastic braces, to swing upward through a small arc until the lifts balance. In flight they actually flap a little, somewhat like a bird's wings, not far, because the centrifugal force, or outward pull, of the fast-spinning vanes holds them down despite the upward push of air under them.

It is this ability of the wings to adjust themselves to equalize air lift efforts that supplies the autogiro's remarkable



How the streamlined windmill vanes operate to lift the craft, and also to stabilize it by equalizing the lift on both sides.

stability. It is self-balancing; air "pockets" or bumps are not felt by its pilot or passengers, and airsickness, companion malady to seasickness, is unknown.

There is no essential difference between the controls and those of an ordinary machine, the ailerons being carried by two lateral spars in Cierva's earlier machines, and by very small monoplane wings in the 1928 model.

THE inventor's greatest difficulties with the first machine were much the same as those experienced by the Wright brothers with the first airplane. First he had to get his autogiro into the air. At the outset this was done by a team of men pulling a rope wound round the root of the rotor, or mast, to give it the first spin required. Since the experiments with his first model, De la Cierva has altered the shapes of his blades several times, until the climbing power of the autogiro has been more than doubled. Today the new model, carrying the pilot and one passenger, has a greater climbing ability than the previous model carrying only one person.

The undercarriage of the autogiro must be very wide because of the slow landing speed. The earlier machines met with several accidents because of narrow undercarriages. In 1927 the development of the invention suffered a serious delay through an accident caused by the failure during a flight, of one of the blades. The other three blades caused a serious crash, the machine falling sideways to the ground.

THE rudder, ailerons, and elevator are governed as in any conventional plane. In some of the machines recently built the inventor has been experimenting with a small wheel on the instrument board which, through low pitch gearing, alters the lateral angle of the mast, causing the ent re l ft reaction to one side or other of the center of gravity. The instruments also are the same as in ordinary machines, with the exception of an extra revolution counter, which is connected with the revolving blades.

The engine having been started and warmed up, a mechanic, instead of whirling the propeller, as with ordinary planes, sets free the rotating blades. Starting into the wind, the autogiro takes off the ground as soon as the wing revolutions have reached eighty percent of their maximum capacity, and while the horizontal taxiing speed is still reduced. The best climbing speed is slower than that of the usual plane, being from forty to fifty miles an hour.

Pilots who have tested the machine say it is extraordinarily easy to fly, and less susceptible to rough weather than other planes. It answers easily and immediately to rudder, elevator, and ailerons. In turning, the rudder is used exclusively, the machine banking almost automatically.

AND now, with the engine throttled down, the autogiro glides at a speed of fifteen miles an hour! It is time for the vertical descent. The pilot wishes to land in a field, surrounded by trees or a small park, or even on a large roof. He pulls back his stick, the earth seems slowly to rise under him. The engine is dead. There is not the noise of the customary descent. The autogiro is stable and under perfect control. Within a dozen feet of the ground the pilot releases his stick a little, the machine surges forward again. Then at three to ten feet above the ground, the stick is pulled back swiftly again, and the autogiro drops slowly for the last few feet.

WITH special undercarriages, such as have been used on some of the experimental machines at the Hamble field, it is possible to drop vertically from any height without harm to the machine, but with a considerable bump.

Pilots who have flown both the conventional planes and the autogiro have discovered this main difference between them: If the engine fails in a monoplane or biplane on the average cross country flight the pilot usually can expect a funeral, or ten days in a hospital, if he is lucky. If the autogiro engine dies there is no stall or nose dive to fear. It descends as safely as a parachute, but under the pilot's control.

Lecturing to a group of British pilots recently, De la Cierva told them: "In an autogiro you can enjoy low flight without anxiety, and nearly all the pilots who have flown any of my machines have described the peculiarly comfortable feeling which is, I believe, equivalent to that of a driver of a powerful and fast car with wonderful brakes, who can enjoy high speed on the roads without fearing the sudden appearance of any obstacle.

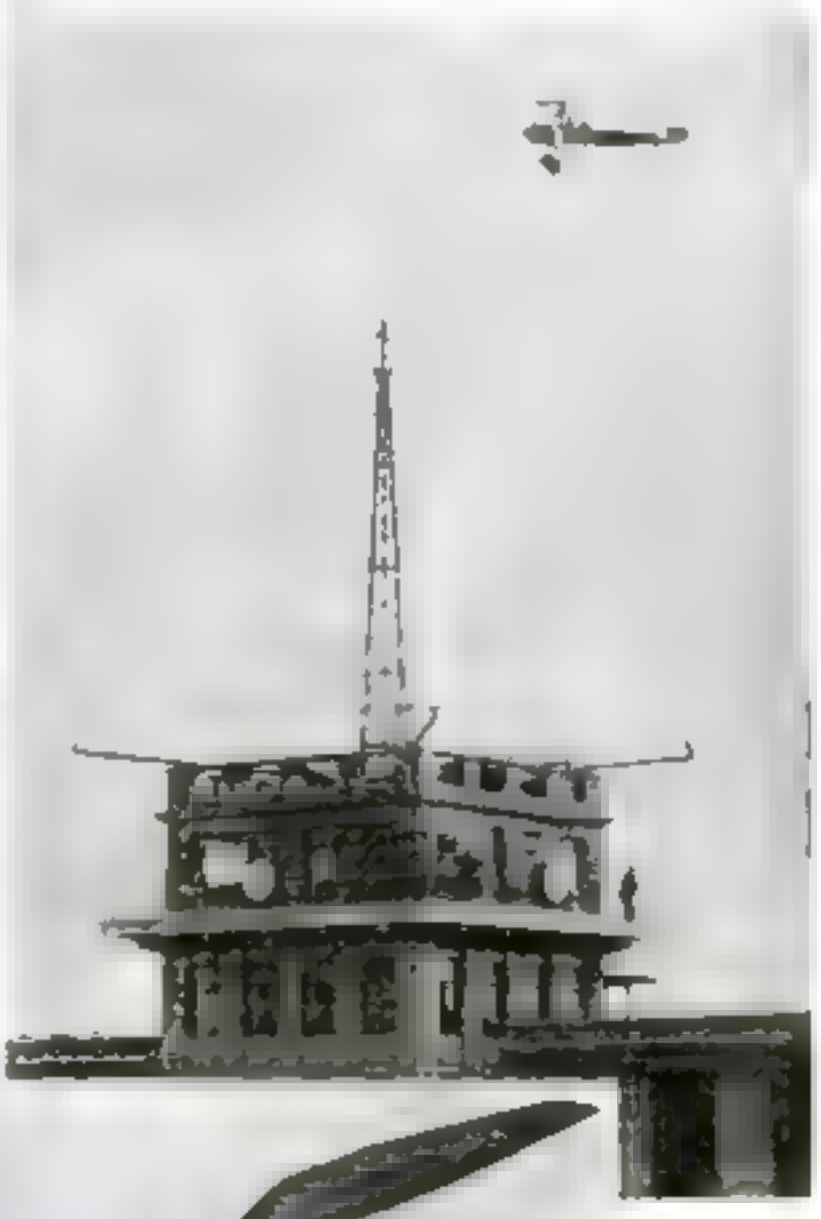
"IF, WHEN flying low in an autogiro—taking off, for instance—your engine begins to lose power and you realise that trees, houses, wires, or other obstacles are only fifty yards ahead of you and cannot be cleared—don't worry. Throttle down the engine and stop the machine in the air in a few yards by pulling back the stick—pulling it right back, as for vertical descent. This is your aerodynamical brake, and it will save lives."

An ordinary plane can be reined in almost as rapidly, as any pilot knows, but the result is often fatal. Nearly always it means a sudden stall the plane heeling over into a nose dive or spin out of control, with resultant smash.

The natural enthusiasm of the inventor has been shared by the British pilots at Hamble. Lady Heath, the woman who flew unaccompanied from South Africa in a baby Moth biplane, recently was given her first autogiro flight in a machine with dual controls, and was delighted with the experience.

Any man can pilot the autogiro, says De la Cierva. It is apparently the one inherently stable heavier than air machine, and no great skill or extraordinarily quick thinking is required to control it. Stalling falls

(Continued on page 160)



Above: The autogiro hovering above Le Bourget Field, near Paris, at the end of its successful flight across the English Channel. Below: The machine at Hamble airdrome, England, before the flight.

© Thomas A. Edison

So They Wrote to Edison—

Surprising Things the Great Inventor Finds in His Flood of Mail Every Day

By WILLIAM H. MEADOWCROFT

IF YOU were to ask any group of Americans who have won distinction in the field of electricity where they obtained their first knowledge of the subject, more than half of them probably will name the same book. It is *The ABC of Electricity*, written in 1888 by William H. Meadowcroft. To this same man, the electric signs which make Broadway famous and which stretch from coast to coast owe their beginning. Meadowcroft was the originator of the application of electricity to display signs.

But, besides being an electrical authority in his own right, he is noted as the man who knows Thomas A. Edison best. For forty-seven years he has been associated intimately with him and for the past eighteen years he has been his confidential secretary. No one in the world is better qualified to write about Edison or his daily life.

In this article Mr. Meadowcroft tells of some of the strange, the amusing, the interesting letters that come from the ends of the earth to Edison's overflowing mail basket. If you have ever wondered what sort of letters the mailman brings a famous man or what the thousands of people, who address him through the mail, write about, you will long remember this inside glimpse into the life of Thomas A. Edison. The Editor.

THE attainment by an individual of even a moderate degree of fame brings with it an unsolicited increase in the number of letters delivered at his door by the postman. His regular business and personal mail may, of course, show a natural and legitimate growth, but in proportion to the extent of the publicity which has brought him into prominence, so will he become a shining mark for the arrows of the ever watchful writers of letters to those in the public eye.

This is essentially so in the case of Edison, who has attained fame in so many directions. It simply resolves itself into a multiplicity of subjects upon which miscellaneous correspondents may spend their efforts, and it goes on year after year. Day by day his secretaries open the letters and, after reserving such as can be attended to by them, place the remainder in an overflowing mail basket on the inventor's desk.

And such a mail! It is doubtful whether Uncle Sam delivers to any other single person such a variegated assortment. Besides reports from various companies and departments and a large number of really important communications relating to his extensive business interests, Edison is flooded with a variety of letters which to answer adequately would make demands on the wisdom of a Solomon, the contents of an encyclopedia, and the pocketbook of Croesus.

Of course, the autograph collector is always in evidence, and if all of his or her desires were satisfied, Edison would become a mere clerk. Parents write to ask what is best to do with sons who show some leaning toward electricity or other arts and sciences. Applicants for positions contribute no small quota. Owners

"I am long on ideas but short on time," says Edison. "I only expect to live to be about 100." Yet he still finds time to read letters from all parts of the world, in the overflowing mail basket upon his desk

of mines (and their name is legion) send samples of ore, asking for analyses, and offer to share their property with the inventor—for a consideration. Boys who are interested in electricity seek illumination on various problems which confront them in their experiments. Deaf people write to ask if he has not made some invention to alleviate their affliction. Doctors, lawyers, scientists, and thinkers send him complimentary copies of books, pamphlets, and papers they have written.

THESE cover an infinite variety of subjects, and some expression of opinion is expected. Faddists and exponents of various "isms" and cults write mysteriously and intricately to get his views concerning hair-splitting theories with which they are wrestling.

Experimenters in almost every conceivable branch of the arts and sciences write to ask his views on some particular line of work in which they happen to be engaged. Quite frequently the latter class of epistles contain lengthy descriptions, covering many pages of more or less intelligible matter, more or less illegibly written; and not seldom there is propounded, quite artlessly, some question that would require the writing of a small volume to answer. A good example of such questions in one case was, "How do they make the most efficient dynamos?" Invitations to banquets, expositions, meetings of societies, and other functions are constantly seen in the inventor's mail.

Requests for interviews by those who have "a very important idea" that can only be explained in person are of frequent occurrence. The "important idea" correspondents are usually called on for a bill of particulars before an audience is considered. The chances are that this finally disposes of the matter entirely.

Several large record books, and notebooks galore, crammed with endless ideas of his own for further inventions, offer eloquent testimony to the truth of what Edison has often said in this connection. "I am long on ideas but short on time. I only expect to live to be about 100."

It is not to be expected that so prominent a mark would not be aimed at by those who send out letters asking for financial aid, either in the shape of loans or gifts. These are plenty, as also are numerous opportunities to finance business propositions. Occasionally comes one seeking to establish a relationship, more or less distant, usually so far distant as to be unrecognizable.

Letters from friends of boyhood or of old telegraph days are far from uncommon and usually meet with a courteous response.

AND, once in a while from various parts of our own country and from all parts of the world, comes a gleam of sunshine in the shape of a letter expressing gratitude to the inventor of the phonograph for the happy hours Edison has afforded them. Other letters convey the appreciation of the writers for the comforts and blessings brought into their lives by his other inventions. Only a very short time ago a (Continued on page 152)

The [illegible] the new airship. Twenty passengers are [illegible]

New Fuel Drives Giant Zeppelin

"BLAU gas" as motor fuel has passed its first real test in the great Germany-to-America *Graf Zeppelin*, for the moment the world's largest airship. When Dr. Hugo Eckener's latest creation rose on its trial trip over Munich, Germany, preparatory to a trans-Atlantic flight to America, its engines were burning gasoline. But a few minutes later the rear motors, their gasoline supply shut off, were fired with the new fuel gas through rubber tubes from the balloonlike gas compartments. Next the forward motors switched to the new gas without missing an explosion.

Success was even greater than expected. So powerfully did the new air-thin gas drive the engines that Dr. Eckener announced the ship would use the fuel gas exclusively.

Latest engineering triumphs are built into the *Graf Zeppelin*, the craft that is Germany's answer to critics of airships as opposed to airplanes. Half again as large as our *Los Angeles*, the 3,700,000 cubic-foot ship is second in size only to Britain's ships, now being built. It surpasses in sheer bulk the Great Pyramid of Egypt.

From it are hung the motor gondolas with their five air-cooled 530-horsepower Maybach motors, and passenger and navigation cabins. Within, the main gondola reveals luxurious accommodations for twenty passengers. Downslanted windows and ceiling lights illuminate a comfortably-furnished dining cabin and lounge. Forward are ten sleeping cabins with Pullmanlike upper and lower berths. Navigation and radio cabins, and an electric kitchen, occupy adjoining compartments.

Within the gas bag itself, the "upstairs" of the craft, live the crew. A narrow catwalk runs the length of the dirigible, which is so long—nearly 800 feet—that it takes three minutes to walk from one end to the other.

Great spaces reserved for cargo and sacks of mail reflect Dr. Eckener's contention that the ship's greatest utility will be as an air freighter. Upon publication of the *Graf Zeppelin's* itinerary, including a trip from Germany to Lakehurst, N. J., and return, the U. S. Post Office Department announced plans to dispatch the first air mail to Germany.

Originally it had been planned to fly the air giant to America last spring or summer. Hence, elsewhere [illegible] new gas, or blau gas as it is known by the men who use it, [illegible] fuel or [illegible] gas settlement for the [illegible] Filled for a trans-Atlantic voyage, the fuel compartment within the gas bag proper holds nearly a million cubic feet at [illegible] enough to keep the gas [illegible] pressure [illegible] pressure night and day for ten years.

This gas is practically as light as air and therefore no appreciable load for the dirigible to carry. Consequently, when part of it is used up, there is little change in the whole craft's weight and it need not valve off part of its precious hydrogen to avoid bobbing upward into the sky, as it would tend to do were gasoline used. Blaugas contains a negligible percentage of high-inflammable gas, minimizing explosion hazard and danger of igniting the hydrogen-filled gas bag above.

BLAUGAS is manufactured by distilling and decomposing crude oil in huge retorts, heated to a temperature of a thousand degrees F.—the heat of red-hot iron. There the oil decomposes and turns into a variety of gases which, after passing through cleaners, coolers, and scrubbers, are stored in tanks. Eight gallons of oil produce 1,000 cubic feet of gas.

Powerful pumps then draw the gas from its holders and compress it, causing most of the gas to liquefy. It may then be transported in steel cylinders, and allowed to expand and re-gasify when needed.

The new Zeppelin's tremendous cruising radius of 7,000 miles could take it from Berlin to San Francisco without stopping. In this factor Doctor Eckener sees the main challenge to the airplane's supremacy—a challenge so real that plans are under way for a dirigible air line from Germany to South America.

Radio Outruns the Hurricane

While the Tropical Fury Blew Paths of Death and Ruin, the "Hams" Stood by to Warn and Send Aid

By

GEORGE LEE DOWD, JR.

For hours, while the cyclonic storm was at its height, Nathan Pomerantz, twenty-year old radio amateur of Brooklyn, N. Y., handled messages to and from the stricken area through his station.

THE whole world was horrified recently at the destruction wrought by the West Indian hurricane that swept a path of death and ruin through Porto Rico, the Virgin Islands, Guadaloupe and several smaller islands, and our own Florida. Scores of ships were wrecked, castles of the rich and cabins of the poor alike demolished, and hundreds of defenceless people drowned in floods that laid waste farms and orchards as the terrific tempest rolled northward.

The tropical storm, one of the worst in modern history, struck the Florida coast with such intensity that at West Palm Beach and Palm Beach alone, nearly 100,000 persons were left homeless and the damage to property was more than $100,000,000.

The hurricane was first discovered about 800 miles east of Guadaloupe in the Atlantic Ocean. It traveled west-northwest over Guadaloupe to the southern part of the Virgin Islands, passed along the southern coast of Porto Rico, then turned northwest, lashing over Turks Island and Nassau to the Florida coast, which it hit with tremendous force. From there, with diminished power, it recurved to the northward and then northeast, passing near Jacksonville, Fla., Savannah, Ga., Charleston, S. C., Wilmington, N. C., and Richmond, Va. Its tail end, assuming the form of high winds and pelting rains, switched over cities of Pennsylvania. It died at last in the vicinity of Buffalo, N. Y., exactly ten days after it was first reported.

ONE of the remarkable aspects of the storm was the fact that though it was predicted by the United States Weather Bureau, three days before Florida felt its impact, still, just as in 1926, the actual arrival of the gale found many communities completely unprepared. An explanation can be found only in the fact that mankind habitually neglects to profit by the lessons of experience.

Another noteworthy feature was the part played by radio, and especially by "hams" or amateur operators, in flashing news of the approaching hurricane to regions along its path. No sooner was the first warning broadcast that the storm had descended upon the West Indies and was rushing northward toward Florida, than all available radio stations in the wind-swept area were pressed into service. With telephone and telegraph wires torn down by gales reaching a velocity of more than 100 miles an hour, these stations furnished the sole means of communication.

STATION WRVS, of the University of Florida, was the first to spread warning of the disaster. The news was picked up and relayed by WCAM, of the Miami Daily News, and other stations. As a result, thousands fled to cover. Commercial telegraph stations meanwhile had flashed word to vessels at sea.

The Tropical Radio Company, despite loss of two aerials at Miami, succeeded in maintaining unbroken communication with the "outside." Contact was established with station WBF, at Boston, and thousands of messages inquiring after the safety of friends and relatives were relayed through this circuit. Assistance in relaying messages and spreading warning was given by ships in the hurricane vicinity, while short-wave stations of the Radio Corporation of America at San Juan and along the Atlantic coast kept a constant vigil.

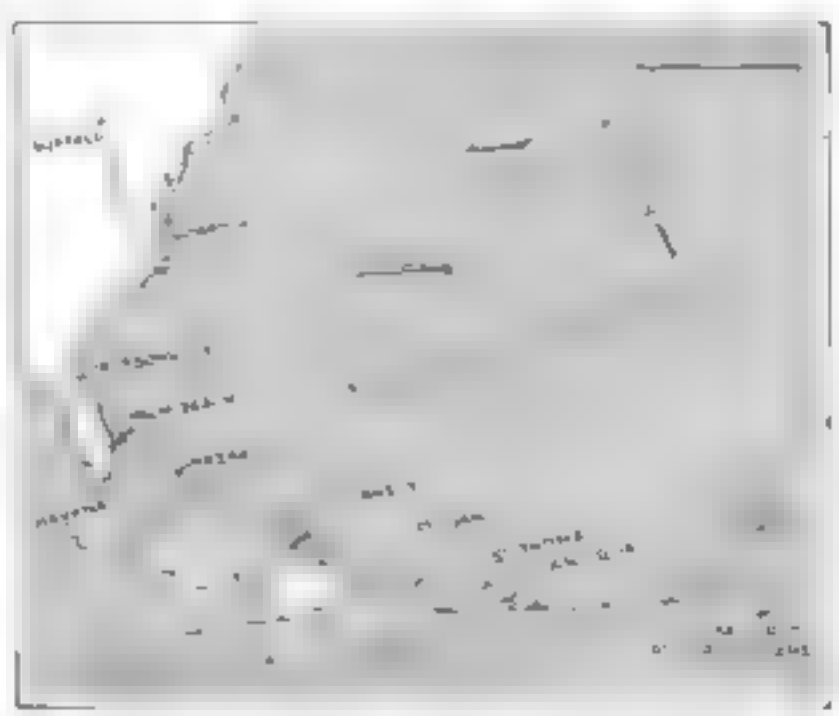
Splendid service was given, too, by amateur radio operators in the United States and Canada and in Porto Rico and the Virgin Islands.

Through his station 2APD Nathan Pomerantz, a twenty-year-old amateur of Brooklyn, N. Y., handled many messages to and from the stricken area. Aside from operating his own station in Brooklyn, Pomerantz worked a low-wave station at the Radio World's Fair, held at that time in New York. These many messages were relayed to Florida and Porto Rico. Pomerantz reported picking up NBB, the naval station at St. Thomas, Virgin Islands, while the storm center was only thirteen miles south of that point.

OPERATING continuously from nine o'clock on Sunday morning until five o'clock on Monday afternoon, amateur station 4AAO, of Homestead, Florida, handled messages for relatives of persons in the affected area. Other amateur stations that did valiant service included 4EI, 4AFC, and 4AGR, at Palm Beach, and 4AFL, at Tampa.

In Quebec, Canada, several "hams" proved themselves Good Samaritans of the air, keeping at their instruments virtually through the entire first three days of the hurricane, relaying messages and standing by for distress calls. Alexander Reid, of station 2BE, St. Lambert, Que., particularly distinguished himself.

How do tropical hurricanes originate? Experts disagree as to their



The path of the recent hurricane. Rising from the Atlantic Ocean east of the West Indies, it swept to the westward and northward.

exact cause, though the theory is generally accepted that they start as eddies between conflicting air currents, while the excessive heating of moist air over a large area of the tropical ocean, with a resultant expansion upward, outflow above, and inflow below, is one of the chief contributing causes.

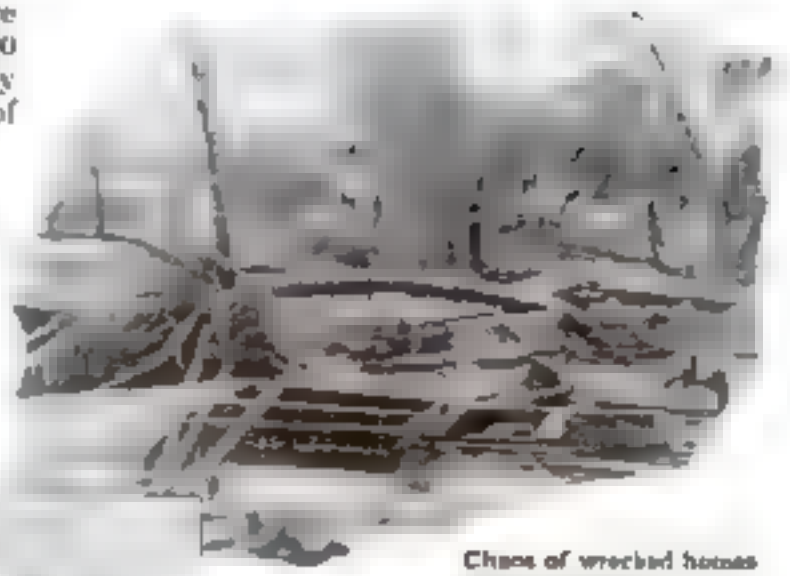
The meeting of conflicting winds, it is now generally accepted, leads to the formation of eddies and ascending currents. A whirling vortex is set up as a result of the deflective effect of the earth's rotation on the winds flowing toward the storm center. This vortex, once created and set in motion, will be kept going for a long time by inertia, in spite of friction, and thus may travel far over the earth's surface before it dies out.

The storm apparently is carried along by the air stream in which it was formed. First it travels westward with the trade winds. Then, if its persists, it is carried along with the general circulation of air around the border of a subtropical high-pressure area into the temperate zone, and later it swings eastward and poleward with the prevailing westerly winds of middle latitude.

A WEST Indian hurricane is, in reality, a cyclone of small area but unusually powerful in its whirling action and consequently of great destructive force. Aside from the West Indies, there are at least four other extensive zones in which hurricanes originate. These are the Pacific Ocean, adjacent to China, Japan and the Philippines, the South Pacific east of Australia and near Samoa, the Bay of Bengal, and the Indian Ocean just off the coast of Madagascar.

The customary name for such tempests in the Far East is typhoon, a word of Chinese derivation. In the Philippines they are called baguios. Cyclone is their designation in the Indian Ocean. In the South Pacific, as in the Atlantic area, the name hurricane predominates. But they all are tropical cyclones.

Sometimes the hurricane is confused with storms which exhibit similar characteristics—the extra-tropical cyclone and the tornado. They are, however, very dissimilar in extent and intensity. An extra-tropical cyclone may have an average diameter of 1,500 miles, and an exceptional one may cover the entire northern half of the North Atlantic Ocean. A tropical cyclone varies in diameter from fifty to 300 miles. Compared with these two, the tornado is a mere midget, its diameter extending from a few yards to half a mile. Also, the tornado is of land origin, whereas the hurricane and the cyclone rise from the waves.



Chaos of wrecked homes and twisted trees at West Palm Beach, Fla.

Ghastly ruin left by the winds. All that was left of a theater in San Juan, Porto Rico, after the recent storm had passed.

But in the matter of intensity, the roles are reversed. In this respect, the pygmy—the tornado—is a giant. It is the most powerful atmospheric blast known, and the deadliest. Its velocity at times reaches 500 miles an hour. That is approximately four times the speed of the average tropical hurricane. Many extra-tropical cyclones do not even rank as gales. The greater destructiveness of the hurricane is due to its sustained power. On the other hand, the tornado is always of brief duration.

Hurricanes rarely continue farther up the Atlantic coast than Delaware. As in the recent storm, the northern cities may experience heavy rain and high winds as a result, but the damage there is negligible compared to that done in the south. What rain and wind the north receives are said to be caused by the fact that a portion of the hurricane reverses its course after heading back out to the ocean.

The immunity of the northern seaboard from the worst fury of hurricanes is believed to be a result of generally prevailing atmospheric conditions, which will not produce the intensity of which tropical storms are capable.

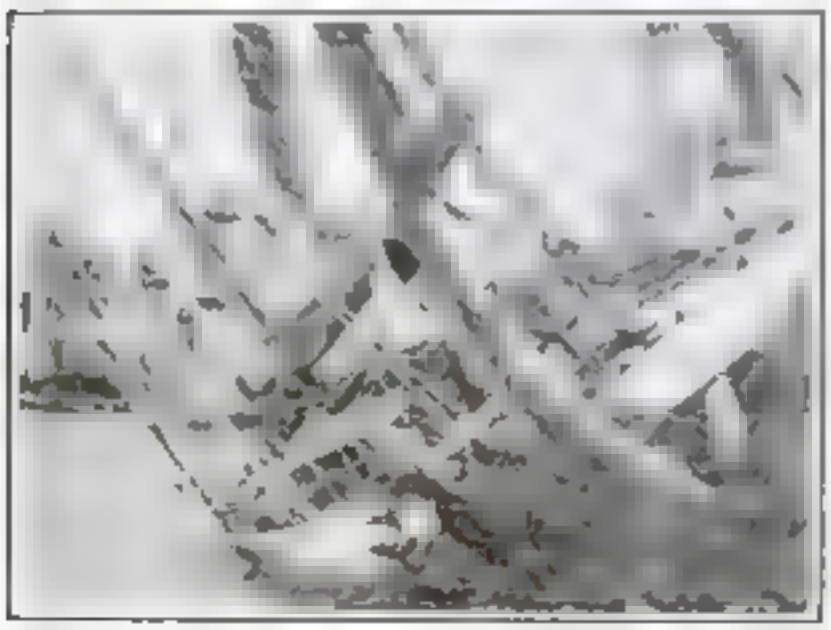
A HURRICANE rarely sweeps far inland. One notable exception was the hurricane which caused 5,000 deaths in Galveston, Texas, in 1900. Beginning in mid-Atlantic, it crossed the Caribbean Sea and Cuba and followed the Gulf Coast from the tip of Florida. When it reached Texas, it swept inland, driving before it a great tidal wave that covered Galveston to a depth of from four to sixteen feet. It then blew over the Mississippi Valley, passed out to sea by way of the St. Lawrence River, and eventually struck Iceland. This hurricane, which lasted about two weeks, was one of the most terrific storms ever recorded.

From time immemorial, tropical storms have scourged the earth, but our knowledge of them is comparatively recent. Before the seventeenth century, hurricanes were known merely as excessively strong and destructive winds. Their rotary motion was not discovered until much later, after the invention of the weather chart, which dates only from the beginning of the nineteenth century. It was finally recognized in 1831.

EVERYBODY, said Mark Twain, talks about the weather, but nobody does anything about it. Hurricanes always have lashed the West Indies and Florida, and there is no prospect that they will ever cease to do so. The only hope for the future lies in the lessons which disasters teach.

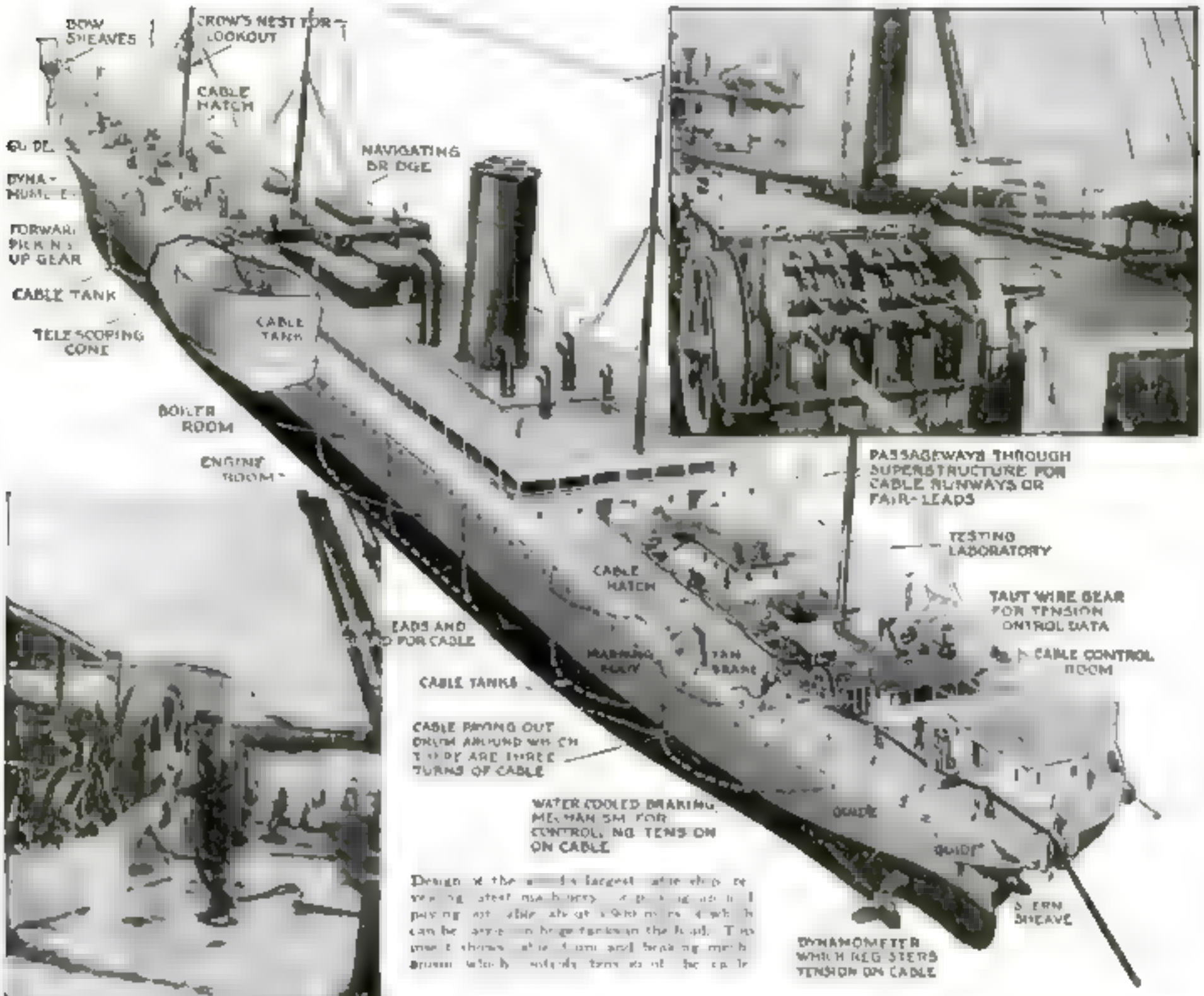
After the San Francisco earthquake, architects and engineers devoted their attention to erecting types of buildings that would withstand a recurrence of the great shock. An article describing the construction of hurricane-proof houses appeared in POPULAR SCIENCE MONTHLY for February 1927.

Emulation of the San Francisco example is the only possible protection against hurricanes and their resultant misery. Humanity cannot avoid the fury of the elements. The time will come when man's innate sense of self preservation, coupled with his ingenuity, will lead him to devise means to resist them.



Scores of vessels were caught and wrecked by the hurricane blast. This remarkable photograph shows a boat blown ashore and left high and dry among the trees near West Palm Beach.

Laying the New Ocean Cable



Four friction brakes, acting directly on the paying-out drum, are cooled by water.

How the World's Greatest Cable Ship Joins the Continents with Miles of Unbroken Wire

THE largest and fastest cable-laying ship in the world, the *Dominia*, recently completed the main link—between Bay Roberts, Newfoundland, and the Azores—of the latest trans-Atlantic cable, which will transmit eight messages at once between the United States, Europe, and Africa. The *Dominia* is 502 feet long, twenty-two feet longer than the *Colonia*, its famous sister ship, which has laid more miles of cable than any other vessel in the world. Its oil-burning engines drive it at a top speed of 14.5 knots an hour. It has a crew of 130 men, and its 180,000 cubic feet of cable space allows it to carry approximately 3,000 miles of deep-sea cable.

Four huge tanks in the hold contain these miles of cable, all in one piece. During a trip, an electric current is kept passing from shore through the length of the cable, lighting a signal lamp. If the lamp goes out, indicating a break or the development of a defect in the wire, the man on watch presses a button which instantly stops all machinery and the ship itself. Wheels and guides lead the cable from the hold to a drum, which it circles three times before continuing through a dynamometer, thence through a final sheave at the stern of the ship and into the ocean.

Through an ingenious system of brakes, the cable engineer governs the slack, which is allowed to take care of irregularities of the sea bottom. A chain connects the shaft of the drum with a fan which revolves in a metal case with adjustable openings that regulate the inrush of air, and consequently the speed at which the fan turns. The greater the pressure of inrushing air, the slower the fan revolves. As it slows up, the chain drags on the shaft, slowing the drum. The fan's maximum drag is equal to the pull of forty horses, but it has an air-cushion effect without sudden jerking that might part the cable.

BESIDES the fan brake, four friction brakes act directly on the shaft, which is cooled by a constant stream of water. A piano wire, played out with the cable, is kept taut and a comparison of the amounts of cable and wire that are let out shows the exact amount of slack in the cable. The dynamometer shows the stress on the cable in hundred-weights and indicates when the pull on it is nearing the danger point.

When the vessel is laying cable on the ocean's bed it plows ahead night and day at an average speed of seven knots an hour, leaving about two hundred miles of copper wire behind it during a twenty-four-hour run.

Mechanical Men Walk and Talk

Amazing Automatons Invented to Operate Mighty Machinery, Speak at Meetings, Make Lightning Calculations, and Rid the World of Drudgery

By ROBERT E. MARTIN

AUTOMATONS, as such, are not new. The inventor Archytas, in 400 B.C., devised the first, a flying dove. A mechanical man that played cards, exhibited in London in 1875, was surpassed only a few months ago by a mechanical chess player, which stopped of its own accord if the human opponent cheated. The German battleship *Zaehringen*, sailing the seas today without a man aboard, is guided by a mechanical pilot with radio "ears".

Marvelous feats, these, but "robots" are in themselves complete evidence that no mechanical contrivance can ever wholly replace human labor. Their very perfection is a tribute, not to themselves, but to the intelligence of the men who designed them and set them in operation. They respond, but man *thinks*.

UPON the rostrum sat a large and awesome figure, not unlike the giant warrior of brass atop the mountain in Shehcrazade's tale. But this huge monster had the cold white sheen of tin, and the experienced eye could tell that aluminum was his substance.

With his armor-plated chest, arms, and legs, and sharp metal joints at the knees, he seemed like a grotesque enlargement of the knights-in-armor that frighten elderly lady visitors in museums.

The Thing's enormous size and the stark monolithity of his face gave him a really terrifying quality. His lipless, toothless mouth agape, his hollow eyes aslant, he stared into an audience that packed the Royal Horticultural Hall, in London. Fairly popeyed, they returned his lifeless gaze. They felt subconsciously that here was some strange symbol of relentless Fate itself.

Then wonder mounted to amazement when, with a grinding, creaking noise, the figure rose and moved his stiff arms in a superfluous gesture asking for silence. Suddenly, the black, dead eyes became alive with a ghastly yellow light. And then—he spoke!

"Ladies and gentlemen," came a rumbling voice. "Unaccustomed as I am to public speaking, it gives me great pleasure . . ."

The spell was broken. True, the voice had an unearthly sound. But the pronunciation was that of the typical educated Englishman, and the words were the time-honored commonplaces uttered by presiding officers the world over.

In such novel fashion, the recent model Engineering Exhibition was opened in the British capital. A scientist of note had promised to preside; but a few days before the opening date, word was received that he would not be able to appear. It was then that Captain W. H. Richards conceived the idea of constructing a man of metal to do the job. This creature not only would take the place of the defaulting chairman, but serve as a most appropriate feature for the engineering show. He set to work quickly and christened his aluminum creation "Eric."

Eric moved and had his being through the means of an electric motor, electromagnets, pulleys, and levers concealed in his body. For raising him from his seat, causing him to bow to the audience, and resume his chair, another motor was concealed in the platform under his feet. Ingenious electrical instruments (a jealously guarded secret of his inventor) enabled Eric to hear questions and answer in a human voice.

In large lettering on Eric's breastplate appeared the initials "R. U. R." (short for "Rossum's Universal Robots"), which were the title of a famous [illegible] by Karel Capek. The Czech [illegible] playwright, in which [illegible] with human passions and human [illegible] . . . [illegible] working automatons.

[illegible] Captain J. A. Roberts.

[illegible] E. J. W[illegible] of the West [illegible] and Manufacturing Company, had astonished a group of engineers in New York by answering the telephone and doing [illegible] . . . [illegible]

The last word in the mechanical man or robot personality was spoken recently when the New York Edison company opened a new automatic power distributing station—a plant with an ultimate capacity sufficient to light the homes of from 200,000 to 300,000 families (a good-sized city!), yet one that hasn't the appearance of Televox, was the Product Integraph, developed at the Massachusetts Institute of Technology, Cambridge, by Dr. Vannevar Bush, professor of Electrical Power Transmission, and his assistants. This marvelous contrivance was described by Dr. Bush as "an adding machine carried to an extreme in its design." But the modest professor didn't go far enough. It is the nearest approach ever made to a thinking machine!

Above: Televox the [illegible] mechanical man which obeys orders spoken [illegible] or electrical waves [illegible] of Chicago's new $3,000,000 sewage plant. Left: Another power plant of the New York Edison Company

"Universal rules as I am to public speaking [illegible] mechanical man, opens the Mode Engineering Exhibition in London

Bowing elaborately, Eric [illegible] salutes the [illegible] and [illegible] the [illegible] in the electrical impulses to the apparatus in question. Likewise, in case any change occurs in the apparatus—for instance if a feeder going to the consumer becomes overloaded or develops a short circuit—the circuit breaker opens, and immediately a signal indicating this is flashed back over the telephone wires to the controlling board, where the lighting of a lamp and the accompanying ringing of a bell call the operator's attention to the fact that something is amiss.

Robots in real action! Robots lighting your lamps and heating your wife's electric iron and oven! Would you have believed it ten, or even five years ago? But that is not all. Soon after the opening of the manless Edison station in New York,

Capt. W. H. Roberts, Britain's inventor-poet, [illegible] for [illegible] by electric motors

Left: Oskar Eric, a [illegible]. Because of the delicate [illegible] done with a hypodermic syringe. The eyes are electric lamps.

a human being in it, but is controlled by an operator three miles distant!

The output of this manless plant is 30,000 horsepower, or about 320,000 man power. In other words, the lone human operator at his switchboard three miles away is really the commander-in-chief of an army of 320,000 mechanical workmen, the absentee nurse of legions of docile eminently useful robots! Here is a development of which Capek never dreamed in his wildest fancy!

THOUGH somewhat different in principle and application from the Televox idea, a similar power sets in motion the Edison robot army, cooped up in a small, one-story building in uptown New York, to supply light and power. The manless plant is controlled through telephone wires over which a series of electrical impulses is sent. These impulses operate a relay in the station. The relay, in turn,

Wensley, inventor of Televox, before the delegates to the American Electric Railway Association in Cleveland, demonstrated the feasibility of manning street cars with speaking mechanical creatures fashioned of copper veins, porcelain bones, and with insulated wires for a nervous system and vacuum tubes for vital organs!

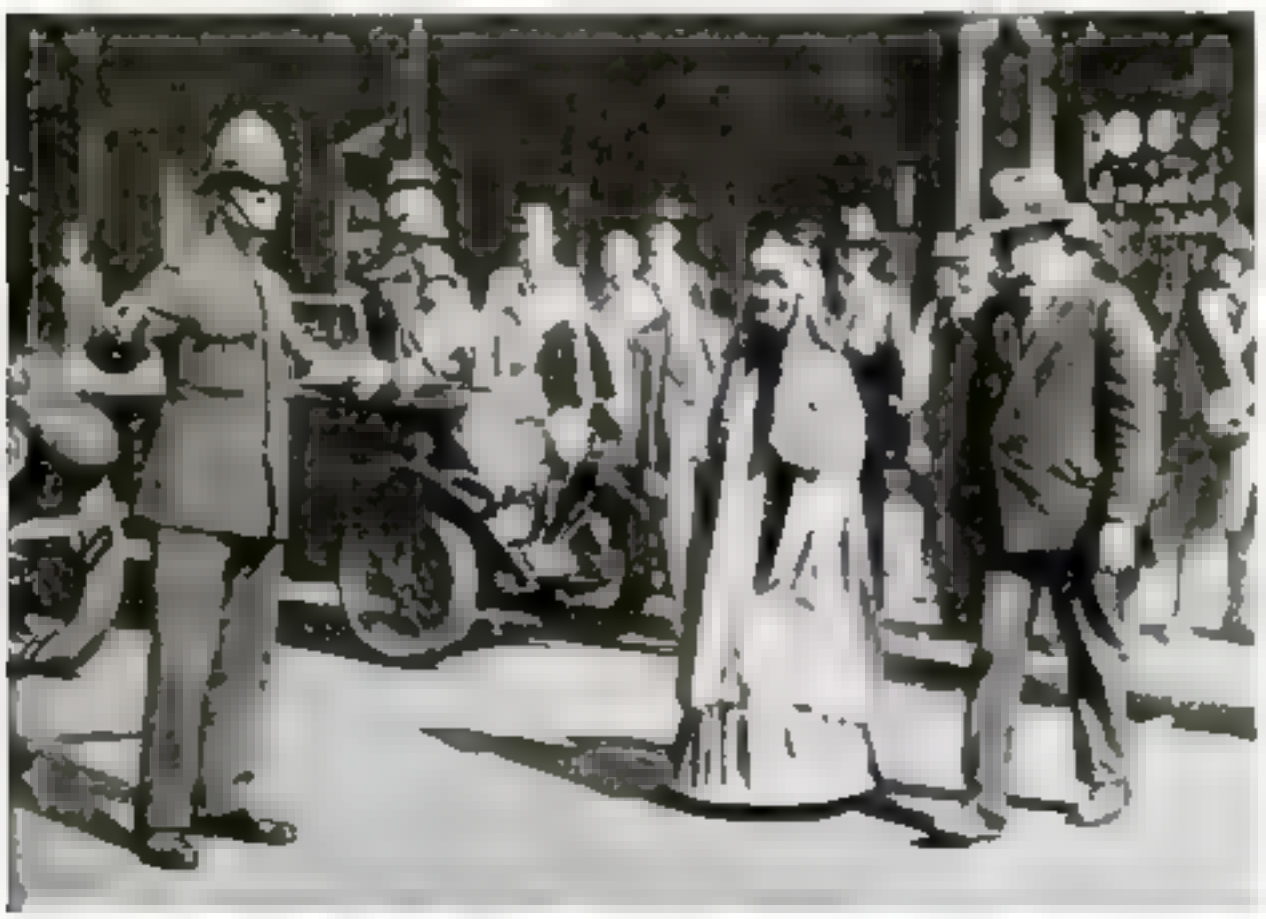
A week or two later, the claim was made in England that forty percent will be saved in the cost of labor through a machine which lays 180 yards of railway track in an hour or re-lays four miles in a single night! The device was tried experimentally by the London and North Eastern Railway Company. Among its features are a circular saw for the automatic trimming of sleepers, an engine which generates its own electricity, and searchlights. An official of the company declared that the track-laying machine hooks up a section of old track sixteen feet long, deposits it on the train, carries forward a new section, and gently lowers it into the position where the old track was.

Another robot with a vengeance!

SHORTLY afterward an antiaircraft "robot" gun, which computes and holds its range against invading aircraft, was used for the first time in a sham war staged at the tenth annual meeting of the Army Ordnance Association at the Aberdeen Proving Ground in Maryland, and astonished nearly 10,000 spectators. The new gun is set in action by sound waves from the approaching enemy plane, which thus, in a sense, commits suicide when coming within its range.

And, also very recently, a peaceable robot did a neat job, when Televox started the operation of a new $31,000,000 sewage disposal plant of the City of Chicago.

(Continued on page 137)



London pedestrians have been looking askance at one another ever since this walking "robot" was seen strolling with her inventor, Capt. J. A. Roberts. A "Bobby" held up street traffic for them.

Romance Rides in the Air

Lights of a great city far below, and the ghostly fingers of airport searchlights, as they appear to the airplane pilot soaring high above the earth.

Stirring Adventures of Famous Flyers Who Have Met the Unexpected, Face to Face, in the Clouds

By MICHEL MOK

"HE KNOWS his way around these parts in any weather" ran the cheery comment of his friends when Mazel M. Merrill, the head of the Curtiss Flying Service, was reported lost on a trip from Buffalo to New York.

Pilots who had made their first feeble flutterings under his sinking guidance, students who had listened to his pithy lectures, and aviators who had flown with him for years agreed that "he could scent trouble before it came."

"Merry," as flyers the country over called him with affection born of dangers shared, was regarded as one of the most cautious, experienced, and weather-wise aviators in the game.

But still, after some days of suspense, another stunning blow was dealt the flying world. The stocky, jovial manager of Curtiss Field, who himself had sent out many a relief expedition, had crashed into a wooded hillside near Pond Eddy, Pa. There his almost unrecognizable body and that of Edwin Ronne, manager of the Buffalo Airport, who had accompanied him, were found. They lay not far from a scattered mass of charred debris that once had been the graceful orange *Falcon*, built for Lindbergh.

And one afternoon a few days later fifty planes, piloted by members of the Quiet Bird Men, the secret flyers' organization to which Merry had belonged and by other aviators, zoomed low over and about a train. Aboard the train was all that was left of Merrill.

The thoughts of those of the winged escort may be conjectured. "Merry" gone West. "Merry," strong, shrewd, genial last week; now in a black box on that train, rumbling swiftly to a far-away grave. A far away grave.

These, mind you, are not sentimental men. A stiff upper lip and quickly gritted teeth come to be part and parcel of those whose daily business is a gamble with the gods. They are brave men, gay men, but they are thinking men.

The fog got "Merry." Of that there was no doubt. Thick weather, low ceilings, and a pea-soup fog had hidden that stupid knoll from Merrill's keen eyes. They had rendered every instrument useless. They had reduced his ship first to a silly toy, then to a heap of rubbish.

BUT what really killed him was the unexpected. Aviation is slowly coming of age, but the unexpected still lurks ahead of every set of propeller blades.

A pilot taking off from a flying field still hops into the unknown. Beyond him are success or failure, crippled limbs or a whole body, life or death. Who knows? Adventure to this hour rides in the air by night and day, and every birdman is aware that triumph and disaster both are hovering 'round his wings.

High winds may face him, or fog, rain, sleet, snow, and hail. Ground mist, low

The pilot flying at night, drops a flare to light his way to safety. From a painting made for POPULAR SCIENCE MONTHLY by Charles Chapman.

clouds, and cross-currents of cold air are possible sinister traveling companions. Then there is always the impenetrable blackness of a stormy night. If he flies high, the surface of the earth is but a blur. If he flies low, he may crash into a hill, a tree top, or a barn, while high-tension power wires, ditches, rivers, fences, and bridges are an ever-present menace.

The unexpected may kill or maim him, but joy and laughter and a lifted heart are also stored above the clouds. And so he gambles and loves the element of hazard in his job.

Who can ever forget Lindbergh's simple but deeply moving description of the first few hours on the memorable night of his trans-Atlantic flight?

Just off the Newfoundland coast darkness envelops the eastbound "We." The temperature has dropped, and the heavy fog and mist have changed to rain. At thirty-eight degrees, it begins to freeze on the *Spirit of St. Louis* and there is only one thing to do—get out of it if possible.

At 10,000 feet the machine climbs out of the sleet storm, covered with ice. Below the pilot are the thick rolling clouds, discharging their sleet into the ocean. He looks above. There a serene moon brightens a deep-blue sky studded with stars.

Lindbergh, completely alone, between the black, roaring ocean and that smiling heaven, winging his way to a remote continent. An hour and an experience which, before him, few men had shared with the angels.

And humor, too, is in the bag of tricks the unexpected offers. No document furnishes such variety of heroism and good, unadulterated American humor as the service record of our air mail pilots.

There is the capital yarn of Pilot Scott who had the unexpected serve him as a surgeon. Paul Scott was flying eastward out of Salt Lake City. He encountered fog and snow, and could not see clearly. Turning south to circle a mountain range, he saw a gap between the fog bank and the clouds over Saddle Pass on the main route. He was halfway through this aperture at an altitude of a mile and a half when the gap closed in front. He banked the plane and turned about.

Impossible to see twenty feet in any direction. The airplane jumped up and down like a bucking broncho. He tried to climb but felt a jar, then another. His wheels were clipping the tops off cedar trees. That was all he remembered.

When Pilot Paul came to his senses, he was buried deep in snow. His left shoulder was dislocated. The arm hung numb and useless. He pulled himself out of his white grave and found the sun entirely hidden by fog. He could (Continued on page 156)

Wonders from Molten Sulphur

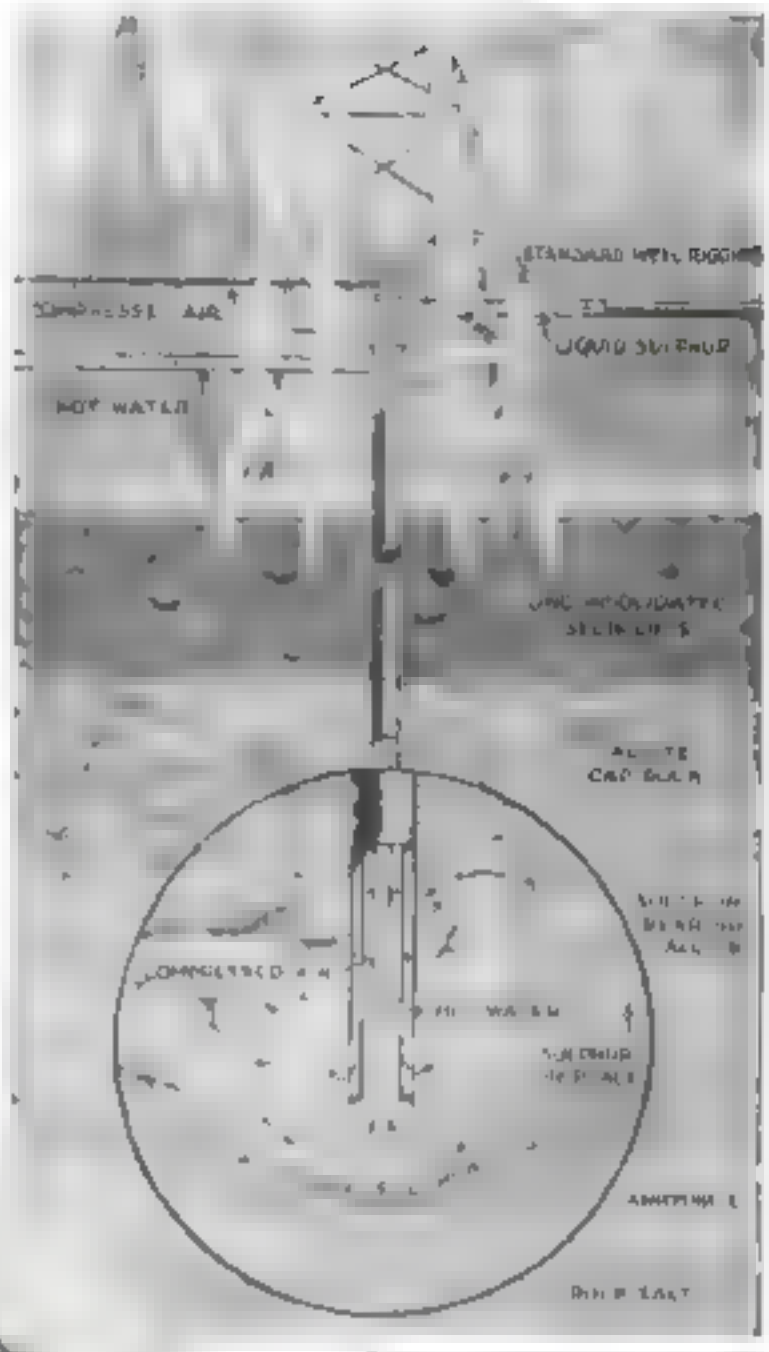
By JOHN E. LODGE

WHEN you scratch a match, you are making use of one of man's oldest and most versatile servants — sulphur. The Egyptians used it to help them paint their inscriptions. The alchemists of the Dark Ages used it in their attempts to change base metals into gold. Now this old element is being taught new tricks. Some of the 200 surprising new discoveries and products from sulphur are described in this article.

IF YOU look in the New York telephone directory under "K," you will find: "Kobbe, William H., sulphur." Behind that final word lies one of the romance stories of industrial science.

To most of us, sulphur suggests only evil odors or memories of sulphur-and-molasses spring tonic in childhood. But to this tall, gray-haired man, with his ready smile, it signifies a fairyland of fascinating possibilities. As far as is known, Kobbe is the only man in the world devoting all his time to finding new uses for sulphur. He has helped discover some 200 applications for it.

In the cabinets that line his office, there is collected a strange array of these products. It includes everything from flowerpots that bounce without breaking when dropped on tile floors, to cutting oils that mysteriously reduce the number of turns necessary to rifle a gun barrel; from artificial marble and rainbow-hued pottery, to pieces of long life railroad ties that appear to be made of petrified wood; from battery boxes, bowling balls, and phonograph horns to sulphur-impregnated concrete which approaches the strength of granite.



© *Texas Gulf Sulphur Company, Inc.*

The modern method of mining deep sulphur deposits of the Gulf states. Hot water, sent down through the pipes, melts and liquefies the sulphur, which is forced to the surface by compressed air.

A million-ton block of sulphur stored in Texas. It is 800 feet long and 65 feet high. Compare it with cars at right.

Great things are expected from this concrete. For instance, sea piling made of ordinary concrete deteriorates rapidly in salt water. But when pilings are made of the new sulphur-impregnated concrete, salt water has very little effect upon them. Similarly, the action of sewage upon ordinary concrete drain pipes makes them short-lived and unsatisfactory. The new sulphur-impregnated tiles resist this action and so are expected to provide an economical method of building sewage drains. Such tiles also reduce the water absorption from 16.8 to 5.4 percent. They have a supporting strength of 1,220 pounds, instead of 340 pounds for ordinary tiles of the same size.

IN MAKING this super-strength concrete, the sulphur is not added during the mixing. The objects are made and then subjected to a bath of molten brimstone, at a temperature of between 140 and 160 degrees C. The hot sulphur penetrates the concrete at a rate dependent upon the mix and the moisture content, but the treatment is usually completed in from one to four hours. By the magic of this ordinary looking yellow substance, objects come out of the bath from four to eight times as strong as they went in!

At Niagara Falls, huge fourteen-foot electrolytic cells, created by Kobbe with sulphur-treated concrete, are being used as part of the equipment of a company depositing iron electrolytically. For more than two years they have been subjected to the constant action of a mixture of hot ferrous and ferric chloride solution. Yet they show little effect of the action of these extremely corrosive chemicals.

An allied use of sulphur is the making of pottery and imitation marble from compositions. At the present time, a factory is turning out such pottery, which, because it obtains color effects impossible by ceramic means, is expected to have a wide vogue.

One of the most interesting applications of sulphur is its use in cutting oils. It has been found that where ordinary oil requires eight turns of a machine to cut steel to a certain depth, oil treated with sulphur produces the same result with one turn! Why? Nobody knows exactly. The theory is that the sulphur increases the adherence of the oil to the metal under extreme conditions of heat. This discovery means a great saving in factories doing thread cutting, gun barrel drilling or turret lathe work.

Sulphur also plays its part in a simple method of discovering leaks in ammonia pipes. Under the pipe, a lighted sulphur taper is passed. If any ammonia is escaping, the action of the sulphur upon it creates a puff of white vapor, thus revealing the exact location of the leak. In a different way, sulphur also helps protect underground pipe lines. Several layers of sulphur-saturated fabric are wound tightly about the pipe. The sulphur shrinks and hardens the cloth into a solid corrosion-resisting covering.

THIS effect of molten brimstone upon cloth is being utilized in a number of other ways. Phonograph and radio horns have been made in this manner. Flannel is sewed into the desired shape and given its sulphur bath while stretched upon a form. The sulphur "freezes" and the flannel becomes as strong and solid as wood. Shapes which cabinetmakers find difficult to create with wood can be achieved by this new process with a minimum of time and expense.

Under the sun of southern Texas, another of Kobbe's experiments is undergoing a service test by the Santa Fe Railroad. On a stretch of test track near Cleveland, Texas, railway ties and fence posts, impreg- (Continued on page 161)

Will Insects Starve Us to Death?

By EDWIN W. TEALE

Moth of the Eu... caterpillar with bro... the size of a postage stamp

Adult male moth of the peach borer making a crawl of a leaf from a peach tree

The Japanese beetle, destroyer of... arrived here on a shipment

Three adults and two larvae of the Mexican bean beetle feeding on leaf

The boll weevil pest which costs cot... planters $500,000,000 each year

The gypsy moth. Ten thousand men yearly fight this devastat...

FROM all over the world recently, scientists journeyed to Ithaca, N. Y., to plan new ways and weapons with which to fight man's unconquered enemy, the insects. The meeting was the Fourth International Congress of Entomology. It formed the strategic council directing the world's army fighting in a war that can have no armistice.

This fight is no longer looked upon as sectional crusades against irritating pests. It is, according to a man well qualified to know—Dr. L. O. Howard, who was for thirty-three years chief of the U. S. Bureau of Entomology — the beginning of a colossal battle of the ages; a silent, little-understood struggle to the death between man and insect, in which the mastery of our planet is the prize.

"The insects," he says, "are man's chief rival for the possession of the earth. They are damaging us more today than at any time since civilization began."

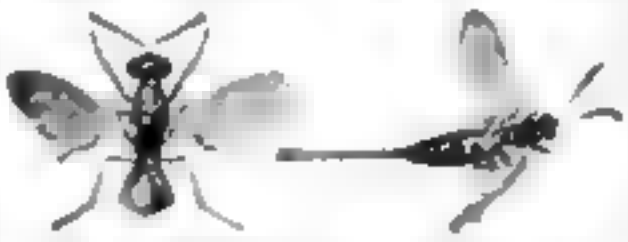
In this increase of our insect foes, strange twists of fate have played their part. A single puff of summer wind, the cracks in a ramshackle barn, and a bunch of uninspected nursery roots, have helped carry the army of insects to its present threatening position.

When a sudden gust of wind, in the summer of 1869, swept around the corner of a house in Medford, Mass., it left behind a trail of damage greater than if it had been a hurricane. In the house lived a French astronomer named Trouvelot, who was carrying on queer experiments with a brown little moth, attempting to crossbreed it with the moths of silkworms in an effort to produce caterpillars immune from plague. From a window ledge the breeze swept a small pasteboard box, containing a few dozen eggs of the brownish moth, to the ground. In spite of frantic searching, Trouvelot recovered only a half-dozen. The rest, no larger than pin points, disappeared amid the grass and pebbles below the window.

For ten years, nothing seemed to result. Then swarms of caterpillars began to overrun the country. They stripped the leaves from trees and left them standing naked mile after mile. So great is the voracity of these caterpillars of the gypsy moth—so-called because the color of the male moth is fancied to be that of a gypsy's face—that if a man had a similar appetite he would require two or three tons of food a day!

Throughout New England spread the insects originating in those few dozen eggs, ravaging the trees as they went. After thirty-five years of fighting, the report comes from the scene of battle that the gypsy moths have been more numerous this year than ever before. Ten thousand men, it is estimated, spend their time fighting this insect enemy in summer months. It is held in check only by a barrier, twenty-five miles wide, extending from Long Island, east of the Adirondacks, to the Canadian border. With pumps so powerful they shoot insecticide eighty feet or more into the air before it breaks into spray, and with sprays attached to hose a mile long, Government fighters patrol the area, struggling frantically to hold back the menacing moths from the thick timberlands beyond. Seven hundred thousand dollars in state and federal appropriations go each year to fight this hurricane of insects which a puff of wind loosed fifty-nine years ago!

In a manner only slightly less dramatic, most of the advance legions of the European corn borer are thought to have come through the cracks of a rickety barn near Everett, Mass. A shipment of broom corn from southern Europe lay in the ramshackle building long enough for the



MANKIND is engaged in the battle of the ages—a war to the death with insect pests. The six-legged invaders that ruin crops and destroy trees are robbing us of two billion dollars a year. Unless man wins, experts say, the world will face a serious food shortage.

One hope of victory lies in insect allies of man, recruited to prey upon the invaders. Only recently a regiment of "lady bugs" went overseas from California to help orchardists in South Africa fight mealy-bugs attacking their fruit trees. The spotted little "lady" beetles first came to America from Australia to attack aphids which threatened Pacific Coast orchards.

Four other allies are pictured here. Above are the *anastatus bifasciatus* (left), a tiny wasp brought from Europe and Japan to feed on gypsy moth eggs, and the *tchaumunon fly*, foe of the European corn borer. Below are the Calosoma beetle, seen eating a gypsy moth larva, and *coccinella concinnata*, an enemy of the gypsy moth

moths of the hidden enemy to develop. They wiggled through the cracks and laid eggs in the near-by cornfields.

The moth of the corn borer, so small a postage stamp conceals it, flies only at night, and the farmers knew nothing of its existence until they investigated a strange blight that swept over the fields of New England and the Canadian border, consuming as much as seventy-five percent of the crop, and in one area of 440 square miles, across the line in Canada, making a clean sweep, leaving only sickly, yellow stalks that produced no corn. Through a single appropriation, this tiny destroyer cost the Government $10,000,000. And this was merely to hold the pest in check with no present hope of driving it out.

IN A similar way, the Japanese beetle arrived as a stowaway in a bunch of iris roots sent from Japan and billed for Philadelphia. Flying five to seven miles at a stretch, and propagating rapidly, the pest swept eastward. In New Jersey and Pennsylvania, where it ravaged orchard after orchard, more than $800,000 each year has been poured into the battle against it, with little result.

At another point, when man was off his guard, a new insect horde advanced. One day in 1892, down at the lower tip of Texas where the Rio Grande flows into the Gulf of Mexico, an insignificant little "bug" landed on a stalk of growing cotton. It had made a nonstop flight across the river from Mexico, where cotton grows wild. With a few friends, it dug in near Brownsville, Texas, and from there fought its way to new conquests. The "bug" was the boll weevil which has advanced through the south, costing the cotton planters $300,000,000 a year.

It has been within the last thirty-five years that all of these enemies of man have gained their foothold. There are many others—the Hessian fly, whose every larva means a stalk less wheat; the tiny leaf-hopper loaded with microscopic bits of virus deadly to sugar beets; the peach borer, the Mexican bean beetle, the chinch bug.

DURING these thirty-five years we have made progress in fighting back the disease-carriers, the aerial squadrons of the insect hordes humming through the air freighted with bacteria or protozoa more deadly than bombs. Most of us know of the fight against the fly, the mosquito, and the other germ spreaders, for it has concerned our health and comfort directly. But, concerning the invasion of these destructive foreign legions which have crossed the border in a dozen places less is known.

The seriousness of this invasion is pointed out by Dr. William Crocker, Director of the Boyce Thompson Institute for Plant Research, in Yonkers, N. Y. In less than fifty years, he says, the United States will have a population of 195 millions, demanding a seventy-five percent increase in food supply. Even now, through insects and plant diseases, we are losing from ten to fifteen percent of all food raised. Insects alone rob us of two billion dollars a year. In other words, one million men march to work every day in the year, just to raise enough food for the insects.

Unless the battle against them is won, Dr. Crocker says, a food shortage for man will result. That the Government is alive to this danger is seen by a glance at the record of its war chest. Two million are set aside each year for research and field study by 400 or more trained scientists of the Bureau of Entomology. Other huge sums are spent in bitter local battles against pests. For instance, California orchardists spend $45,000,000 a year, almost as much as the Federal total.

The reason that the six-legged little enemies have swept ahead in spite of the hundreds of millions in gold and the thousands of trained troops in the field, is twofold. One answer is that nowhere else in the world are such large areas devoted exclusively to the same crops year after year. The other is that when these invaders came they traveled light. They left behind the parasites, which in some cases destroyed as many as ninety percent of their young. So they worked in the fertile fields of the new territory unhindered by their natural enemies.

Opening fire with a powerful spray gun against gypsy moths entrenched in woodland oaks. Pumps shoot a spray 83 feet.

Ruin in the wake of an insect invasion—woodland at Dracutville, Mass., stripped by gypsy moths. After a 35-year war, the pests are more numerous than ever.

In this latter fact science sees its strongest hope for ultimate victory. Only half the insects live on plants or infest the larger animals or man. The other half live on fellow insects. So emissaries have sought in far countries for strange insect allies to help in the struggle.

One such recruit is a beautiful, metallic green, tree-climbing beetle from Europe. It runs from twig to twig of gypsy moth infested trees, devouring caterpillars at a great rate. Its only defect is that it is overcome by drowsiness along in August and goes to sleep for ten months.

TWO other enemies of the gypsy moth have come from the Orient. One, a small fly found in Japan, and also in Europe, is being raised in the laboratories of New England and "planted" in colonies of ten thousand in infested regions. The other is a tiny wasp which attacks clusters of moth eggs and lays its own eggs within, knowing that the little wasps will hatch first and eat their hosts.

For the development of such allies, the "Gypsy Moth Laboratory," one of the strangest in the world, has been established in Medford, Mass. In small glass vials, tiny parasites, brought from all over the earth, are raised with infinite care. Some kinds are fed twice daily on a mixture of honey and water.

(Continued on page 154)

Rows of bean plants destroyed by the Mexican bean beetle. At the extreme left are a few rows of living plants, protected by spraying.

Queer Things Found Eatable

Roast Grubs, Fried Ants, Snakes, Skunks, and Monkeys Even the Earth's Soil—Are Relished in Far Places

VOLCANIC earth for food is the latest addition to a world's menu already distinguished for its variety. From the slopes of Mount Asama, a Japanese volcano, come reports of a curious edible soil, capable of sustaining life indefinitely Found six inches to a foot below the top soil, it tastes like unsweetened gelatin. High officials confirm the claim that it is nutritious.

There is almost no limit to what a man can eat. Most of us may be too fastidious to extend our diets beyond a few familiar dishes But—

Almost every kind of insect is used somewhere as human food With tree grubs, wriggling under the bark, Java natives make excellent stews, or they roast them on spits. In many lands juicy white ants are more of a delicacy than a pest. Africans eat them raw or well cooked in grease Brazilian merchants of Sao-Paulo display great "occodome" ants dressed up like dolls, advertising others they sell to the aborigines for food. For dessert the honey ant, repository of sweet nectar for the ants' use, is popular in Mexico In Siam, ants eggs make a paste with the flavor of sweet almonds

Nor are caterpillars despised as food. Larvae of the large Pandora moth, according to Dr. Austin H. Clark, of the Smithsonian Institution, are relished by Piute Indians of Oregon, in the eastern foothills of the Rockies.

SNAKES are eaten today by natives of our own Southwest, of Australia, and of South America, and, Dr. Clark says, "They are very good, as I can testify." Skunk meat hardly sounds attractive, yet Prof E. H. S. Bailey of the University of Kansas, declares, "The natives of some parts of Argentina class skunk steak as a delicacy on the order of our yellow-legged pullets."

Human nature always has revolted against the introduction of strange foods. Potatoes and tomatoes met with opposition when they were introduced in Europe as did grapefruit in America. In many cases it has been simply a matter of getting used to the novelty. Monkey stew or minced monkey probably would be enjoyed by anyone who did not know what animal was before him, according to Prof. Albert M. Reese, zoologist of West Virginia University, who has sampled everything from woodchucks and muskrats, both of which he says can scarcely be told from rabbit, to big lizards (iguanas) and salamanders. The latter are common in Mexican markets. Alligators furnished Prof Reese with cuts which he found almost equal to veal cutlets.

As for vegetables, of 16,000 plants examined by E. O. Jordan chairman of the Department of Hygiene and Bacteriology at the University of Chicago, only about three percent were found to be poisonous; the rest are theoretically edible. Even the poison may be destroyed by cooking, as in the case of the bitter cassava, South American root, whose deadly prussic acid is removed by running water and heat before eating

"I CAN'T eat these earth worms; they don't agree with me," some Chinese boy may be saying today. But his parents eat and like them. Great quantities of the familar worm are canned and consumed. Of all sea foods, the Chinese prefer large, fat sea-slugs, the size of your hand They make a sustaining broth that has merited introduction into some of the Australian hospitals

Delicious salads from chrysanthemums are made by the Japanese; and white locust (acacia, flowers make appetizing fritters One of the greatest sources of Chinese flour is the water-lily bulb. Many Asiatics subsist on kelp and other forms of seaweed, there are 200 edible varieties. In Tokio, a curious marmalade obtained by cooking wild bees in a special syrup is a treat.

You wouldn't eat these foods, perhaps; you're prejudiced. So is the European against the clam which you find such a succulent appetizer. Similarly we turn up our noses at mussels, prized for food abroad. How, then, can we accuse Arabs of poor taste in their preference for fried crickets?

ELSEWHERE in the world than in Japan, where natives term the volcanic soil first described as "mountain-god barley food," there are whole tribes of eartheaters. Java natives reduce clay to a paste and bake it like gingerbread cookies; even in Spain lovely ladies consume cakes made of gritty sand, though more for their complexions than for nutriment

Perhaps the day is not far distant when, due to rapid travel and to necessity, our diet will include nearly every insect, plant, and animal which does not poison.

The Birth of Aviation, A Great Human Document

Begins in Our Next Issue

ON DECEMBER 17, 1903, Wilbur and Orville Wright, bicycle mechanics of Dayton, Ohio, launched a frail contraption of canvas and wood from a North Carolina sand dune and gave the world the airplane.

It is almost unbelievable, yet after twenty-five years the real story of the Wright brothers has never been told. The world has wondered how two obscure young men, neither of whom had finished high school, could perform the complicated technical research that laid the foundations of the science of aerodynamics. The Wright brothers themselves would not speak.

THEN, years later, Orville Wright, the surviving brother, told John R. McMahon, a writer well known to readers of POPULAR SCIENCE MONTHLY in detail how the airplane was born. He opened the diary in which he and his brother had recorded their experiments, showed him correspondence, telegrams, memoranda, family records.

MR. McMAHON has woven these fascinating facts into a moving, gripping tale, lighted by flashes of humor and revelations of character that make it of constant and absorbing interest. The first installment will appear in our January number.—The Editor.

It almost swims. On a 100,000-mile run this Oakland is splashing hub-deep through the apron of Gillespie Dam, Gila River, Ariz

Finish of the Studebaker marathon, in which two stock roadsters went 50,000 miles at an average speed of 65 miles an hour.

Making Your Car a Better One

By

ALDEN P. ARMAGNAC

IN THIS absorbing article Mr. Armagnac takes you behind the scenes where the motor cars of today are tested and proved in breath-taking feats of speed and endurance. He introduces you to the daring pilots who put your new machine through its paces—to the "Cannonball" Bakers who swirl around the speedways, plunge along the open road, ride over mountains and through floods—to the end that all of us may have better and sturdier automobiles to drive.

BRAKES squeal. Four motor cars grind to a stop in front of a man waving a checkered flag. Haggard drivers slump forward over their wheels. It is the end of the race, a 50,000-mile epic of men and machines at Hammonton, N. J. And none too soon. The track is going to pieces!

For eighteen days, cars racing faster than a mile a minute have pounded it mercilessly. Through blazing heat and driving rain they have circled it monotonously, lap after lap. At night colored riding lights—one red, another orange—have flashed past the timers in the pit, supplementing painted hood numbers visible only in daylight. Now the drivers are resting after their gruelling test, awaiting the timers' report.

Here it comes. Car Number One, thirty thousand miles in 20,320 minutes. Many a car's entire life run off at express-train speed in eighteen days! Number two, only three minutes more for the 30,000-mile marathon around the wooden saucer. All stops included. Two cars have run at an average speed of sixty-eight miles an hour for nearly three weeks, day and night.

AND the most amazing thing about the whole performance is that these are not racing cars—they are stock cars; identical, down to the bumper and rear view mirror, with any you may see in a dealer's window. Two President roadsters picked at random from the assembly line of the Studebaker Corporation's Detroit factory are the holders of the sixty-eight-mile record just described. A pair of President sedans chosen, like the roadsters, by representatives of the American Automobile Association, turned in sixty-three-mile averages. So carefully did Association officials make sure that these four were stock cars and nothing more, that they took them apart and put them together again.

On the same Hammonton track, Auburn cars have run at an eighty-five-mile-an-hour pace for twenty-four hours, with time in the pits included, two thousand miles in a day! Other cars have performed feats as amazing.

Such tests as these, however, are more than an endorsement of any particular make. They are a tribute to the astounding stamina of the modern automobile. They proclaim that the vehicle you can buy today is a tried and tested Viking of the roads.

Not long ago 331 drivers, taking turns, drove a Whippet roadster thirty days and thirty nights without once allowing the motor to stop. At the end of a 12,906-mile run through Pennsylvania and New York states, the car entered an Ithaca, N. Y., speedway and broke a track record for stock four-cylinder cars over a five-mile distance. By way of comparison, a young man named Lindbergh pointed his monoplane at Paris and asked but one thing of his sturdy Whirlwind motor—that it keep going for just about thirty-four hours.

When man and motor match their endurance, the man comes in a bad second. It is no question of how far, or how long, the car can go, but simply how long its driver can stay awake. Chained to the wheel of an Oldsmobile with regulation U. S. Army handcuffs, Roy L. Haines, at Anaheim, Calif., drove it for seven days and nights before he gave in. The car was still going strong.

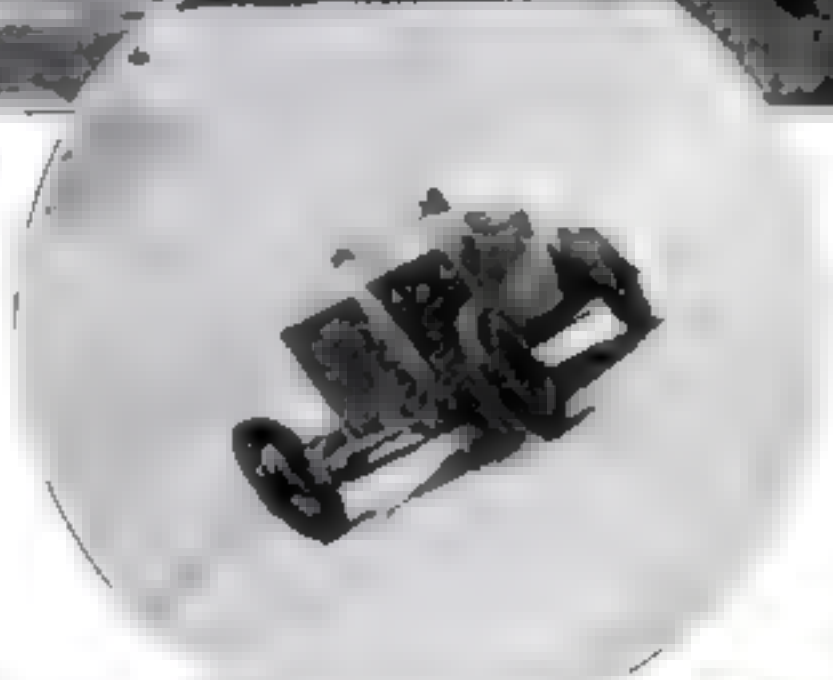
ONE morning last June, just at daybreak, a mud-stained and dust-covered Franklin sedan leaped off a ferry and into New York City. At the wheel was "Cannonball" Baker, one of the most colorful of all race drivers. In six days and a half he had dashed across the continent from New York to Los Angeles and back again, hanging up a new record for the round trip. His time of just three days and nights—seventy-two hours flat—from Los Angeles to New York, was the fastest ever made on wheels between the coastal cities. At times his speedometer needle had flickered past eighty, and his average for the entire round trip was more than forty miles an hour. That included all stops!

In another record run, "Cannonball" drove across the continent in high gear for the first time in history. He was given an Oldsmobile from which low gear, second speed, and reverse had been removed; and thus he piloted from New York to Los Angeles, climbing high mountains that had never been attempted in this manner before.

Through one of the worst floods of the South's history, a few months ago, two men pounded a Reo roadster from Miami to Chicago in thirty hours and twenty-five minutes, covering the 1,601 miles in thirteen hours less time than the fastest trains. Motorcycle escorts whizzed with them through the larger cities. The Dixie Limited, crack train of the Chicago and Eastern Illinois Railroad, and the

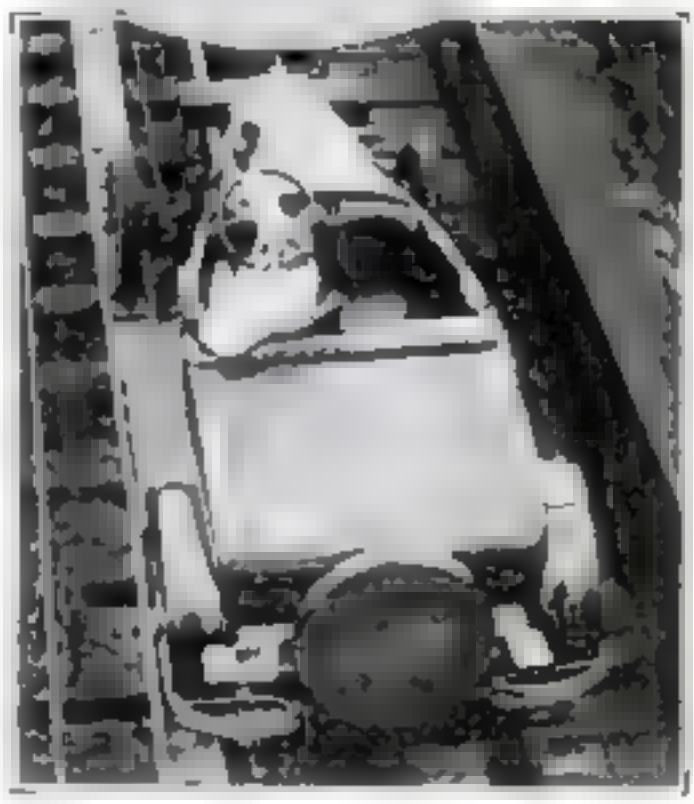
Plowing through sand-swept roads, this Reo roadster ran from Miami to Chicago, 1,601 miles, in a little more than thirty hours.

Just another week? No. It's the finish of an heroic test of strength of a new British car. The driver teetered it on the edge of an embankment, then got out, letting the car somersault into a gully.



Floridan, pride of the Illinois Central, which both make the trip in a little more than forty-three hours, use eight engines and eight engine crews to make their scheduled; but the Reo came through with the same power plant and the same two drivers it started with.

Automobile makers have almost run out of mountains over which to test their cars. Pike's Peak, Mt. Diablo and Mt. Baldy in California, and Stone Mountain, Georgia, have been conquered repeatedly. This year a standard model Auburn car set a new climbing record for stock cars by racing to the summit of Pike's Peak in less than twenty-two minutes. It finished the trip within four minutes of the time set by the fastest racing car in a duplicate event for special machines—a striking tribute to what racing and engineering tests have done for stock models.



A hair-raising climbing feat up the 37-percent grade of a Pittsburgh cableway in a Whippet, a 650-foot climb in 46 seconds. In circle: A stripped La Salle roadster making a 951-mile run at an average speed of 95.3 miles an hour on proving track.

IN A novel variation of hill-climbing stunts, blocks were nailed to make a runway up a precipitous Pittsburgh, Pa., cableway for street cars. A Whippet car climbed the 650-foot, thirty-seven percent grade in the amazing time of forty-five seconds. Then it turned around and came down in neutral gear, with only the four-wheel brakes to save the driver from being hurled to his death at the bottom.

Impromptu performances of cars, as described by their owners, are even more impressive than many of these prearranged speed and endurance trials. For instance, H. M. Fenwick, tool salesman, was in a hurry to get from Los Angeles to New York. With a companion, he set out in his Dodge car. A collision in Arizona held him up three hours for repairs, but he was in New York just seventy-six hours after his departure from the west coast. He had beaten the fastest limiteds.

Two young men of San Antonio, Texas—W. G. Hundley, Jr., and G. F. Wroten—learned that an auto race was to be held. Without knowledge of their parents, they stripped a family Dodge of top and windshield, entered it in the race, and won at a sixty-four-mile-an-hour clip.

The despair of junkmen, and of auto dealers who would sell him a new car, is J. H. Christiansen, of Benkelman, Neb. His Oakland car has piled up 225,000 miles on its speedometer to date, and is still going strong.

Not long ago, William J. Lemer, Jr., telephone man of Pasadena, Calif., played the part of a modern Paul Revere in his newly-purchased Oldsmobile. He was driving in Santa Clara valley when the great St. Francis Dam broke, loosing a wall of water upon unsuspecting inhabitants. Life or death to them was a matter of minutes. Lemer heard the thunder of the oncoming torrent, wheeled his car about, and dashed back to spread the alarm. Next day, when the torrent had partly subsided, he was first in the field with telephone wires to restore communication to the stricken area. He drove through two-foot-deep lakes, using pieces of rubber hose to keep his car's manifold and crank case inlets above water. With chains on all four wheels, the car wallowed through water-buried sands, cleaving the water like a boat.

FROM Africa comes the story of a thrilling rescue in which the stamina of the modern car meant everything. On the summit of Mt. Kenya, in the eastern colony of that name, the explorer Martin Johnson and his wife lay stricken with fever, too weak to move. Down through the trackless forest of the slope to the motor camp below, thirty miles distant, a native bearer raced to dispatch one of the motors to Nairobi, 200 miles away, for a doctor.

But when the bearer arrived, John Wilshusen, in charge of the motors, decided differently. He got together fourteen men with axes, ropes, and spades, pointed his Willys-Knight express wagon up the mountain side, and stepped on the gas. Through the forests he crashed. Sometimes when hardwood trees barred the way the men chopped them down; often Wilshusen simply battled them down with the car. For fourteen hours he battled with the jungle, until at last he was at the summit that had taken the explorers five days to climb. The Willys-Knight became an ambulance, and slipping, swaying, skidding past precipices and ravines, Wilshusen rushed his human cargo down the side of the peak to civilization and safety.

FROM Cape Town, on Africa's southernmost tip, to Cairo at its northern boundary, by way of the Union of South Africa and Rhodesia, is a trip that no one but a bold man or a mad man would attempt during (Continued on page 135)

The "old man of the North." Thirty years of his life were spent in polar expeditions, for which he prepared as a boy. Death was but another great adventure.

AMUNDSEN! The very name carries the sing of the Arctic winds; the mystery of the white places of the earth. Of all men, he alone had stood at both frozen tips of our spinning world. From boyhood, his life was dedicated to the lonely polar trails. And when, a weathered old man, he roared away into the white silence, on a winged quest of rescue, it was his beloved land of snow that claimed him at last. Even today, as Byrd and Wilkins plow southward toward the Antarctic, it is the spirit of Amundsen that leads on. This is the story of

The Last of the VIKINGS

By BOYDEN SPARKES

SOME fishermen of Norway, steaming with their trawl nets through the rough seas twenty miles off shore from the town of Tromsö, salvaged recently a last souvenir of the great adventurer, Roald Amundsen. It was a pontoon from the hydroairplane in which he had flown northward to the rescue of the wrecked and marooned crew of the *Italia*, airship of General Nobile's polar expedition.

Old friends, and especially old companions of his Arctic and Antarctic explorations, accepted the battered sea boot of the flying machine as proof that Amundsen was dead. It was for them as if the pontoon spelled out "finis" for a career unrivaled by that of any explorer who ever lived.

When Roald Amundsen flew from Tromsö in a giant Latham plane of the French government, it was June; when the pontoon was recovered, it was September. The huge hydro-airplane offered Amundsen the only possible means of transportation to the distant shore of Spitzbergen, from which he hoped to direct the rescue of the *Italia's* men. In June the airplane engines had been tuned to the warm air of France in preparation for a trans-Atlantic flight to New York. Overnight preparations were made to send it to the Arctic. Major Rene Guilbaud, hero of a nonstop flight to Madagascar, was the pilot. Lieutenant Courverville, just out of the hospital after the amputation of several fingers, was the relief pilot. Besides these two there were Valette, a radio operator, and two others. The five rose from the Seine and flew northward to Tromsö, where Amundsen and Lieutenant Dietrichson, a Norwegian flyer, were taken aboard and the plane refueled. Then the flight was resumed.

SOMEWHERE out over the sea the engine must have failed. Adolf Hoel, himself an Arctic expert, believes the flying rescue expedition turned about at the first sign of engine trouble and was returning to Tromsö when it fell into the sea.

What really happened remained an unsolved mystery. There could be little doubt that Amundsen and those with him had perished, but the old explorer had returned to civilization so many times in his career after everyone thought he was dead that a kind of legend had grown up about his name. So, when fishermen saw smoke arising from the uninhabited wastes of Edge Island, near Franz Josef land, people of Norway said "It's Amundsen." That was before the finding of the pontoon. But for that evidence of disaster, many of them still would be looking for the return of the only man who ever led successful expeditions both to the North Pole and the South Pole.

THE passing of Amundsen ended a career of exploration without parallel. This great Viking went farther, stayed longer, and suffered fewer hardships than any man who ever penetrated the frigid polar areas. Fully thirty years of his life were spent in polar expeditions, for which he began to prepare when he was a boy in high school.

When Amundsen was fifteen he read the works of Sir John Franklin, the British explorer who had been trying for years to discover a northwest passage around America, carrying on an effort that had cost the lives of British adventurers for more than 400 years.

"Strangely enough," Amundsen has recorded in his autobiography, "the thing in Sir John's narrative that appealed to me most strongly was the sufferings he and his men endured. A strange ambition burned within me to endure those same sufferings."

That seems a curious incentive for a career. Franklin and his men had eaten their own boot leather to keep alive. They had sustained life by a soup of picked bones found in a deserted Indian camp—and reading of this a Norwegian boy was bewitched by the Arctic.

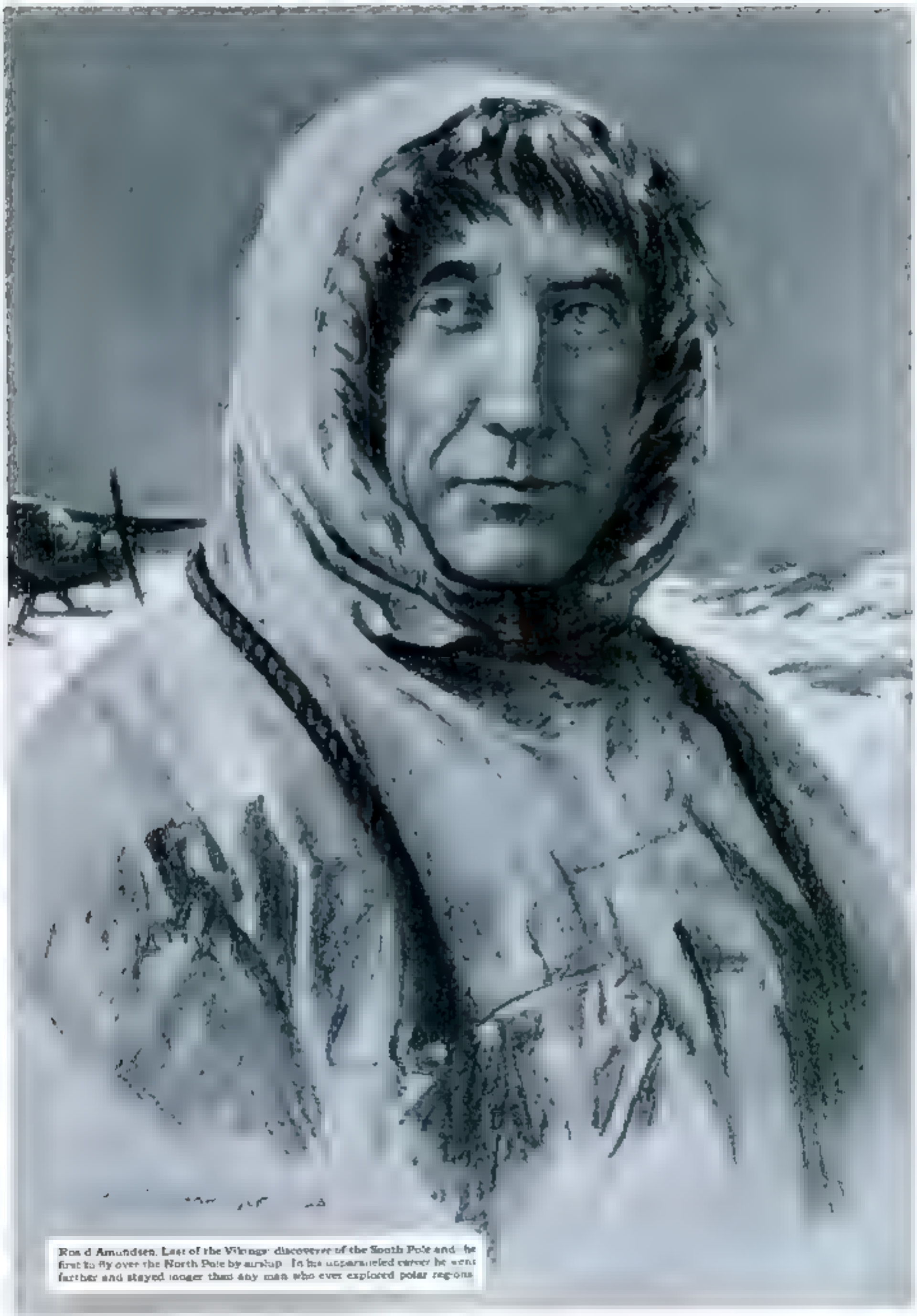
He was born in 1872, a few miles from Oslo, the capital of Norway. When he was a few months old his parents moved into the city, where he attended school until he was eighteen. At fourteen he lost his father, and thereafter was dominated by an ambition of his mother that he become a physician.

A glance at a map of the world will show what contrary force was pulling against that mother's plans. The relatively little known world we call the Arctic slapped its challenge unceasingly in the cold waves from the North Sea. There was a frontier to inspire boys of Norway, as our own Wild West stirred the boys of America.

AS A Boy Scout of today hunts out sparse woodland near our cities to practice "frontier" life, so young Amundsen practiced living as an Arctic explorer. He began to train his body to endure hardships. Because he insisted upon sleeping with his windows wide open to the blasts of a Norwegian winter he was regarded as a freak by neighbors, who kept their windows tightly shut. At every opportunity he was off into the hills and mountains that rise on all sides of Oslo. He traversed miles on skis every day that ice and snow were on the ground. Other times he played football to toughen his body.

At eighteen, when he was graduated from college, he was a marvelously developed athlete. Then, in accordance with his mother's desires, he entered the university at Christiania (as Oslo was then called) and began studies for the medical profession. He had completed little more than half the course when his mother died, and he promptly left the university. He set his face toward the career of his desire.

EAGERLY he entered the army for his term of compulsory service. Once he made a daring trip on skis, in dead winter, across a plateau that was deserted even by the Lapp herdsmen who ranged there in summer. It nearly cost him his life. With a companion he became lost and wandered half starved for several days. One night he tried to find shelter by bur- (Continued on page 162)

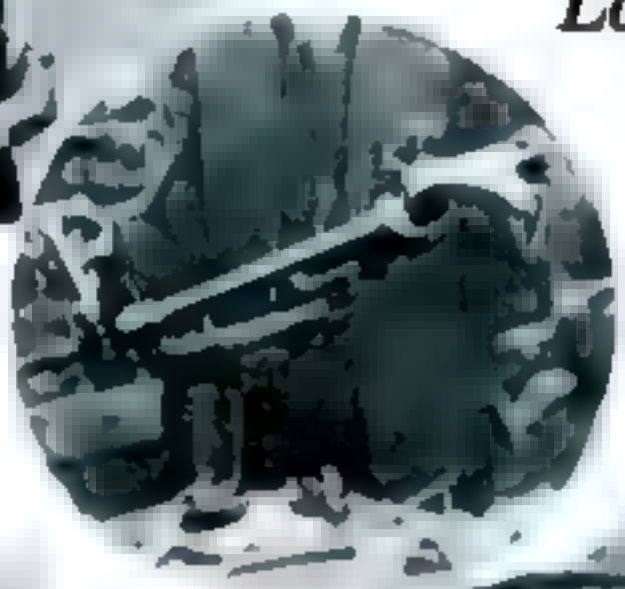


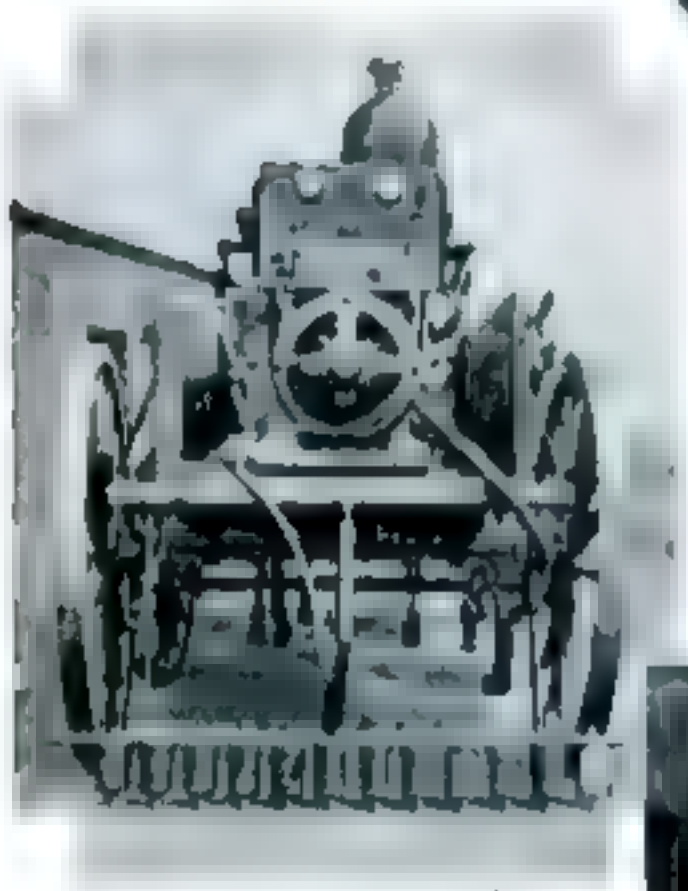
Roald Amundsen, Last of the Vikings: discoverer of the South Pole and the first to fly over the North Pole by airship. In his unparalleled career he went farther and stayed longer than any man who ever explored polar regions

Someone Needed It

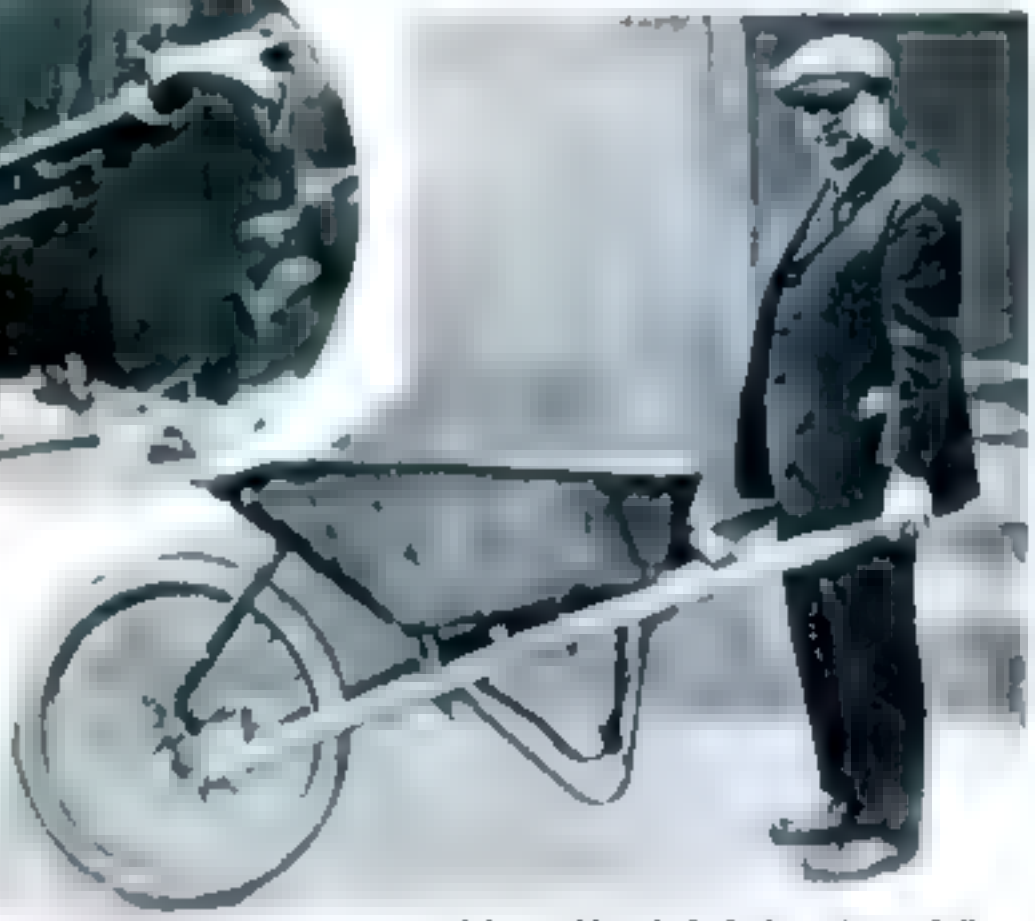
A Magnet Sweeps Tacks from , Runs Minus a Crank Shaft; Latest Inventions to

Cutting sheet metal in the shop has been simplified by the French inventor of this new shearing tool—a steel disk turned by a shaft geared to a crank handle. The tool also may be used in a vise, as shown at the right.





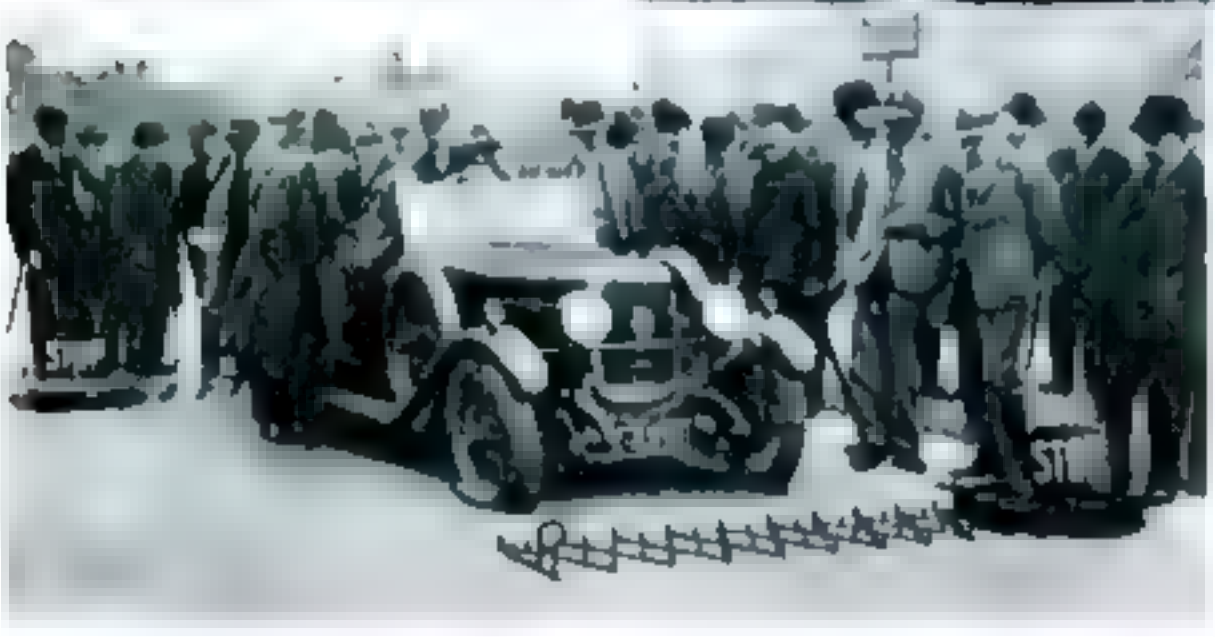
Dragged over roads about the U. S. Veterans Hospital at Fort Bayard, N. M., this ingenious magnet has swept up four tons of nails and bits of metal that menaced motorists' tires. A generator supplies the current.



A large rubber tired wheel, turning on ball bearings, makes easy work of pushing the wheelbarrow, according to G. T. MacFadden, inventor, of Portland, Ore. He finds that the pneumatic tire absorbs much of the shock of bumps and ruts, saving energy.

Finding the elusive keyhole in the dark is simple for the man who carries the latest vest pocket flashlight (right). It has a snap top, like a cigarette lighter, to protect the bulb.

How two young inventors recently made a fortune with a machine to mend runs in women's stockings was told in last month's issue. Now a French inventor has developed this little device with which, he says, any woman can weave back the ravaged threads whenever an unsightly run is discovered.

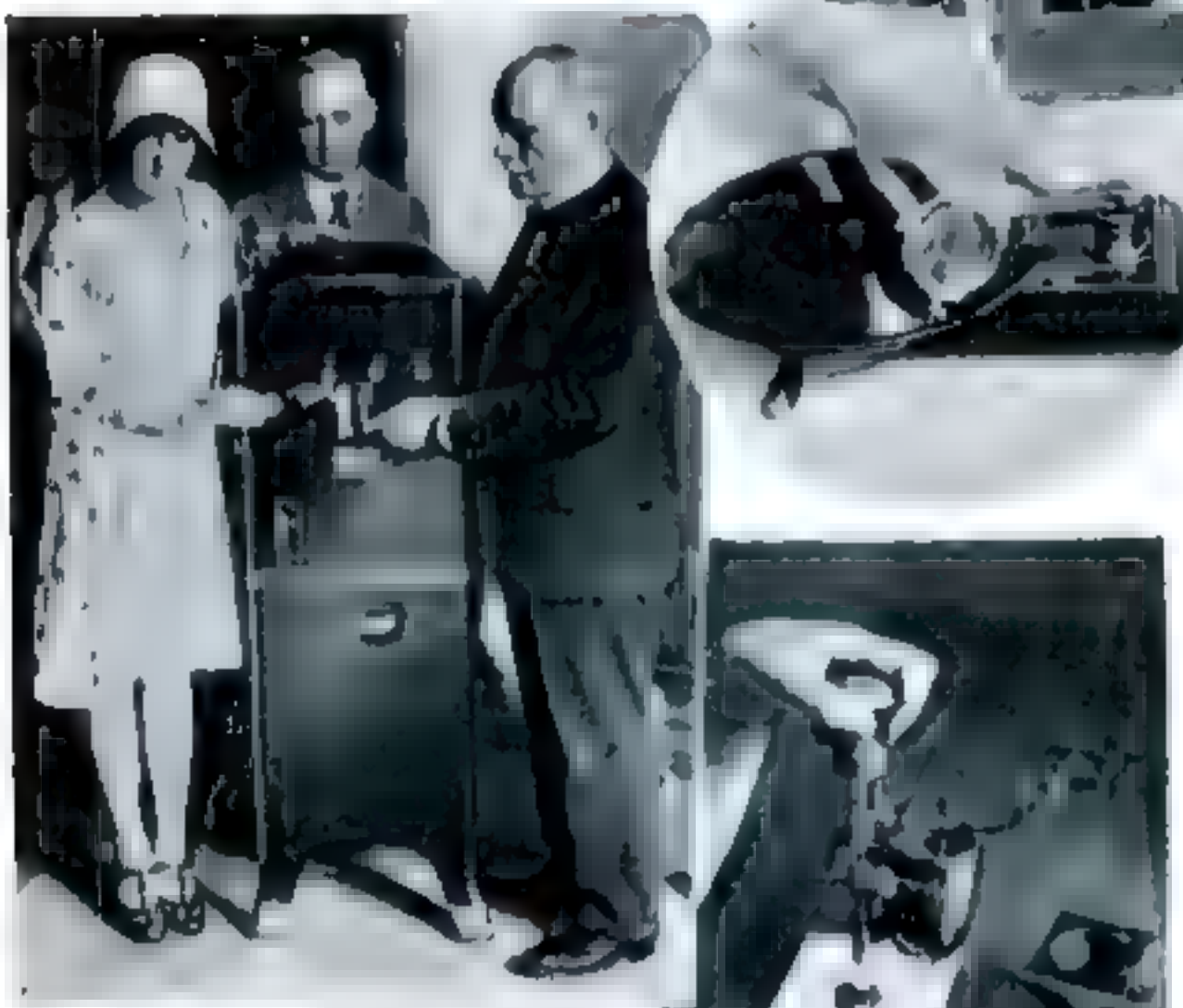


Fleeing motor bandits who ignore police commands to halt are brought to a quick stop, with tires as flat as pancakes, by a new ribbed barrier (left), recently demonstrated in London. When extended across a highway a "Stop" sign warns passing automobilists of the obstruction.

—and Here It Is!

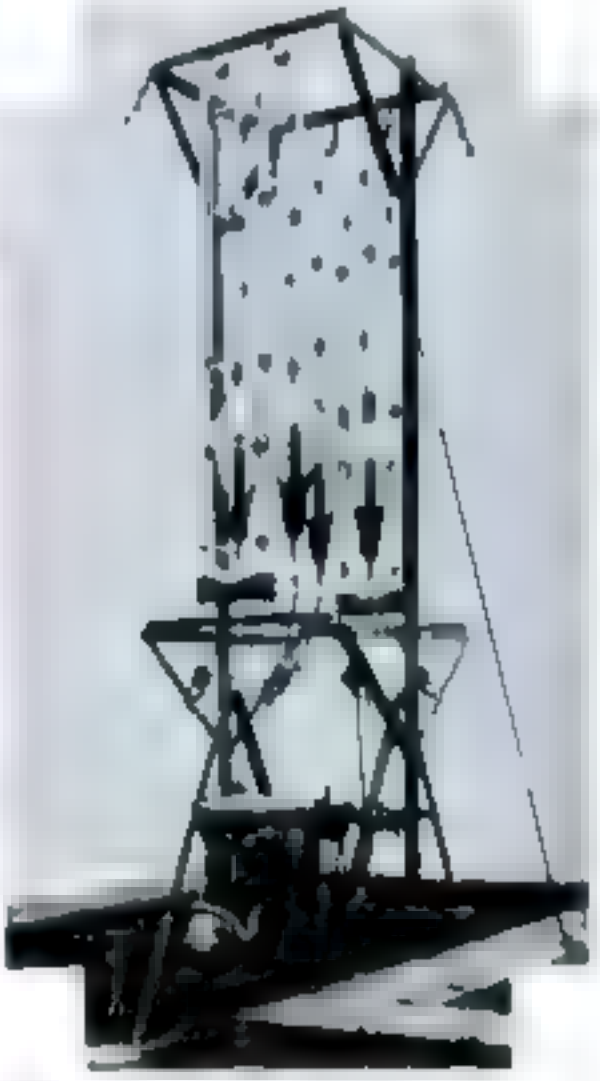
the Road, and a New Motor Fascinating Glimpses of Meet Modern Wants

The latest in portable phonographs folds into a case no larger than an ordinary suitcase. A fiber box within serves as a "horn" and gives ample volume. A single winding plays any standard ten- or twelve-inch [illegible]. The detachable crank and tone arm [illegible] the case.



You don't have to hunt for change to buy one-cent or two-cent stamps from the new stamp vending machine recently installed in the Los Angeles, Calif., post office. It returns correct change for any coin you deposit in the slot at the left. Mary Postmaster O'Brien is demonstrating how it works.

Even the mailing wax outfit has become electrified. In this French invention, the wax is held in a small crucible heated by a coil. Melted wax runs through the central shaft onto the paper, and is pressed by the moistened seal at the end of the shaft.



Huge neon lights of New York City's largest air beacon recently flashed for the first time from a hotel roof. On clear nights flyers can see the orange-red light when seventy-five miles away. It is said to penetrate fog for twenty-five miles.

Paul Marchetti, San Francisco mechanic, demonstrates here the revolutionary motor-type motor he has designed without crank shaft or timing gears. He claims it virtually kills vibration. The principle will also be applied to airplane motors.

Turning the handle of the device shown at the right binds typewritten sheets like a book, thereby doing away with paper clips. Toothed wheels interweave the margins.

The crawl—most modern of swimming strokes, used by Johnny Weissmuller and other champions—was nothing new to Egyptian swimmers 3,500 years ago. Prof. James R. Dunlap, of the University of Michigan, cites newly found records to show that in 1,900 B.C. swimming instructors on the Nile taught the same stroke. Note resemblance between this ancient hieroglyphic picture and the photograph of Weissmuller in action.

They Played Our Games *Ages Ago*

Swimming Champs of Old Egypt Did the Crawl Down the Nile, While Ancient Greece Had Its Bag-Punching Pugilists, Hockey and Soccer Stars—Just as Now

Gene Tunney in training? Guess again. It is an old-time Greek heavyweight pummeling his right in a bag of stuffed skins. The blow is a bit high but Tex Richard is right many pick him out

The up to date boxer uses the same sort of a leather punching bag in much the same way as did the classic Greek champion of 3,000 years ago when he went in training for an important battle.

Greek football stars of old played our modern soccer variety judging from this bas-relief recently found in ancient ruins. Juggling the ball with knees was a part of the game then as now

A spectacular play in a modern soccer game. Notice that the player who is stopping the ball with his thigh is in precisely the same position as is the ancient Greek player in the bas-relief at the left.

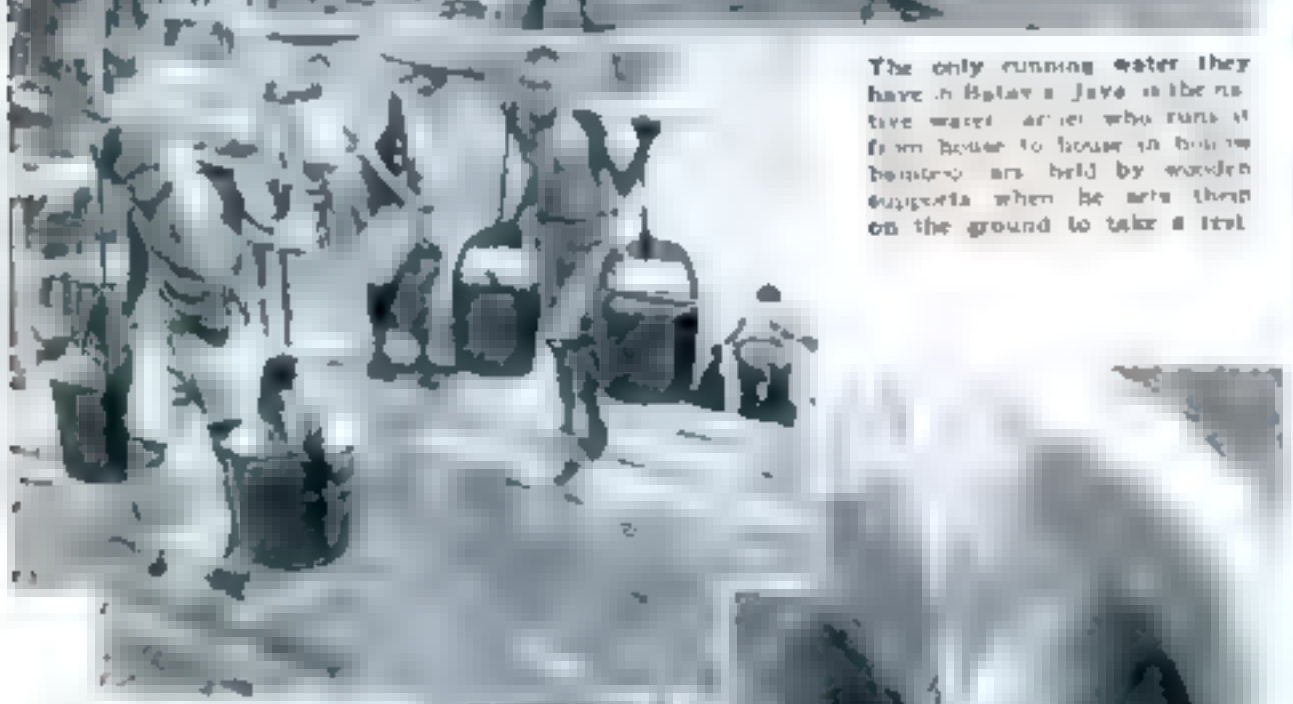
We used to call it "shinny." Nowadays the game is increasingly popular as "field hockey." What the ancient Athenians called it we do not know; but the bas-relief of 500 B. C. (left), found at Athens, shows they hurled their shins at the game long before shin guards were invented. Compare the ancient and modern pictures. "Bullying" the ball evidently was the same chopstick scramble then.

The World Must Drink, and So—

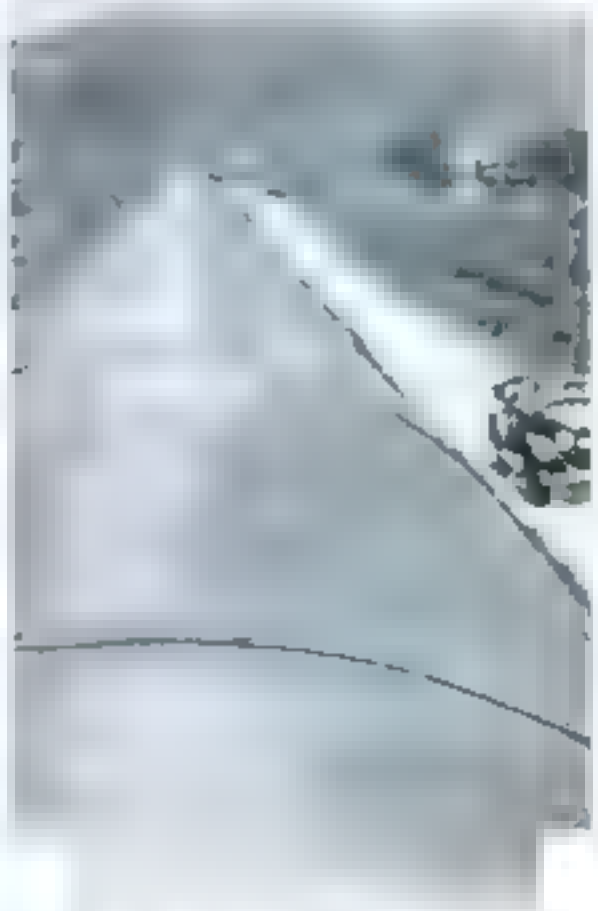
Out on the parched desert of Algiers the Arab lowers his small skin bucket on a narrow well some thirty feet deep. The well's location is marked only by a toy cone of gypsum to protect it from blowing sand, but the thirsty Arab never fails to find the water

Close by the great pyramids and sphinx of Gizeh lies this oasis reservoir lined with palms. There travelers in the Egyptian desert fill their skins with water for the journey ahead.

The only running water they have in Baiae, Java, is the native water carrier who runs it from house to house in bamboo containers. These are held by wooden supports when he sets them on the ground to take a rest



The water works of the city of Chungking on the Yangtse River, China. The pumping machinery consists of strong backed coolies who dip buckets into the water and sling them over their shoulders



How the modern American city gets its water. This mighty new siphon tube of the Los Angeles, Calif., Aqueduct carries water for a million people over the hills. It's a long step ahead of the primitive methods shown on this page

A whole army could march through the huge siphon pipes of the Catskill Aqueduct, one of the newest units in New York's vast water supply system. The picture at the left was taken at a triple fork in the fifteen-foot passage

For peeling potatoes or fruits, this tubular knife has a guard which can be rotated to regulate the thickness of peeling. With guard removed, the tool becomes a handy apple corer. The blade has a sharp point.

A new solid and nonexplosive fuel, portable for picnics and camping trips, comes in the form of tablets which are broken up and used as needed.

Besides a can opener of the new wheel type, this handy tool combines a corkscrew and bottle opener. A notched wheel of the can opener engages the can's outer rim, guiding the cutting point as it is swung around.

They'd Please Any Housewife

A hinged lever on the lower window sash engages a notched strip on upper sash, locking lower window when opened.

Turn a crank, and this new tool, attached to a table, cores your grapefruit. A pair of knife-edged jaws bite out the core.

This new portable electric laundering machine combines both washer and dryer. No wringer is needed, the maker says, because the compact device whirls the wash dry before the clothes are removed. It is small enough to use on the sink drainboard or in a bathtub, where it is handy for sudsweek wash.

Flimsy hosiery and undergarments of the sheerest fabric are safely washed. It is claimed, with a diminutive new "ruxproof washboard," which can be used in a wash basin or even over a basin.

Sharp teeth in the bottom of this new carving frame, and skewers at the top, hold the most awkward piece of meat so that it can't slip away.

A new self-latching gas cock (at left) makes it impossible to turn on the gas accidentally. The spring handle must be lifted to turn.

Ice cream in thirty seconds is claimed for this remarkable freezer which reverses the usual operation. Ice and salt are placed in the revolving cylinder while the cream freezes on the outside, within the movable housing.

Something new in can openers. A jointed lever locks it firmly to the can's rim, and a few turns of the handle with thumb and forefinger draw a knife blade around top of can

Though heated by electricity, this new iron has no troublesome cord. Instead it obtains current by contact with a special receptacle wired to any wall socket. The contact block is seen in rear of iron at the right.

A wide rim near the base of this aluminum pot permits it to rest like a lid on the coal range, supported just above the hot coals. Potatoes are boiled and vegetables cooked better in this way, the inventor declares.

The latest dustproof covering for stored clothes converts a trunk or chest into a filing cabinet, in which each garment is filed into own envelope. Each envelope has a convenient handle

You may forget to turn off the gas hot water heater but this automatic timer won't. When set to run the heater for a desired time clockwork ticks until a spring suddenly turns off the gas cock

This compact electric ironer requires no more storage space than a vacuum cleaner. Used on the kitchen table, it plugs into any wall socket and heats in four minutes. Its ironing surface equals ten flatirons.

For the breakfast nook the latest convenience is an "electric shelf" that hangs on the wall near by. It is fitted with handy outlet plugs for cooking appliances. Any two appliances may be plugged in at once.

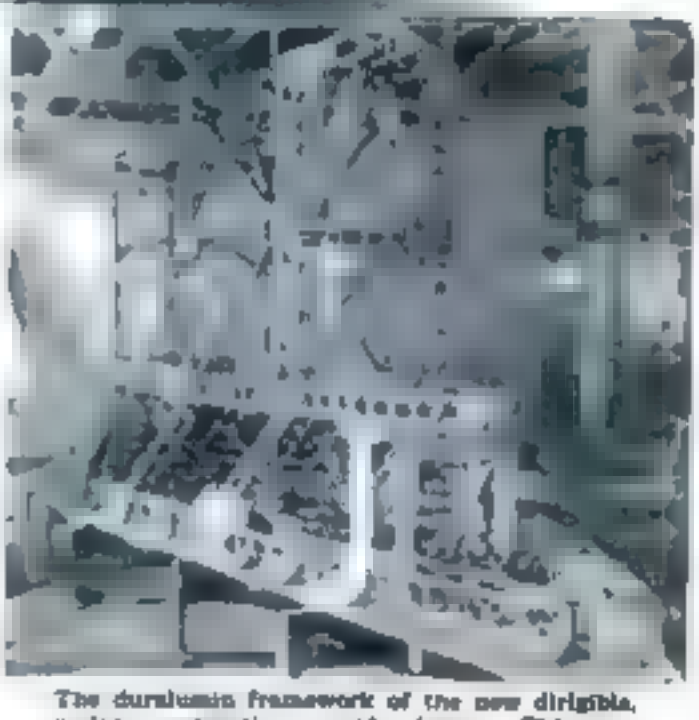
Keeping Pace with Aviation

To develop standard airway markers, flyers have been testing the visibility of roof signs on the Department of Commerce Building

America's new "baby" dirigible *Puritan*, recently launched at Akron, Ohio. She is 130 feet long, 37 feet wide, and carries four passengers.

Cracking radio interference from airplane motor ignition systems during flight now is smothered by covering spark plug wires with new grounded sheaths of woven metal fabric.

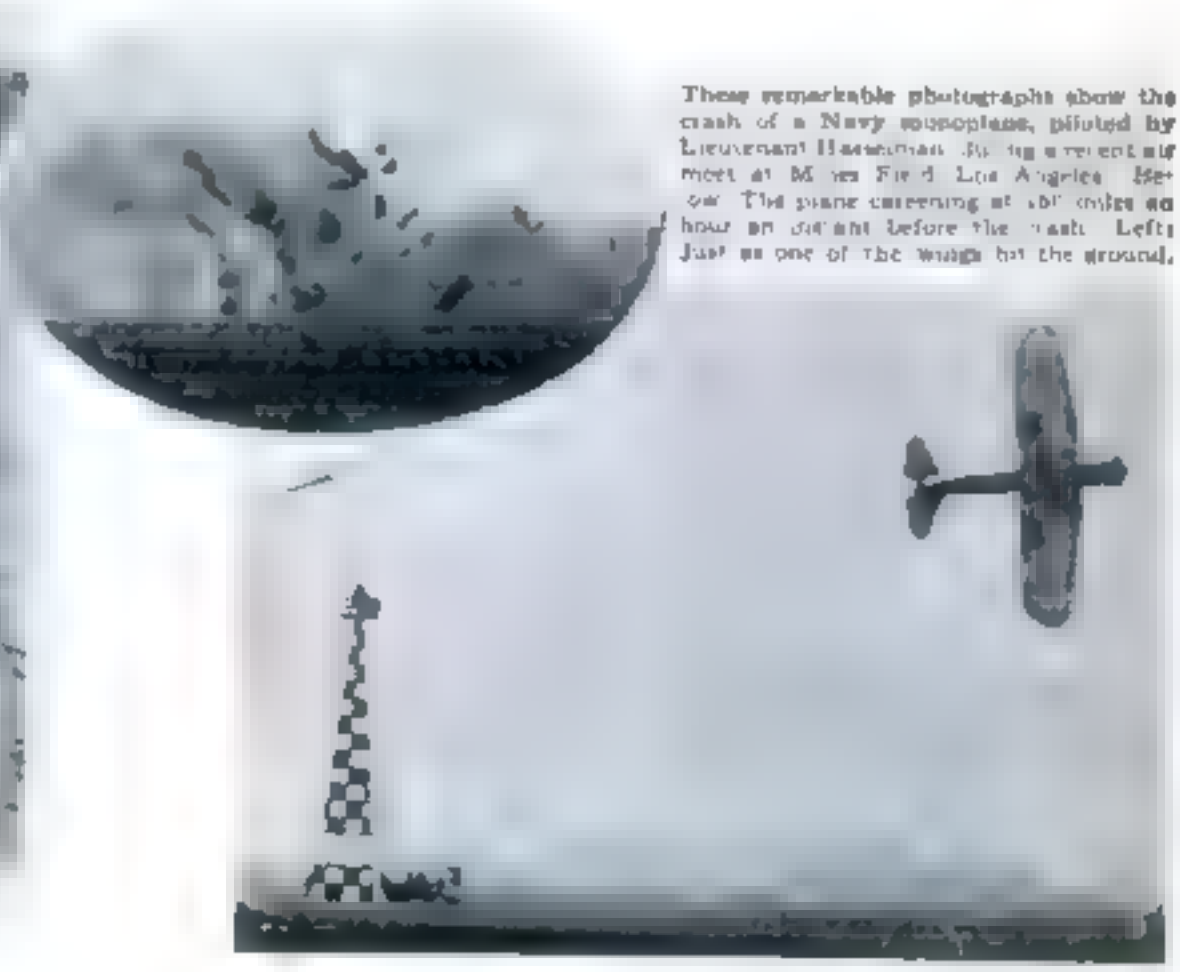
If your radio brings you the voice of a parachute jumper broadcasting his experiences on the way down, it's Ivan de Villiers at the microphone of new miniature broadcasting outfit, weighing 25 pounds.



The duralumin framework of the new dirigible, under construction, upside down. This new structural design is the same as that developed for super-airships of the Zeppelin type. Circular openings in the girders replace the old triangular cuts, resulting in greater strength with extreme lightness. The ship will speed 58 miles an hour.

A curious flying machine, just invented in Germany. The wings, controlled by disks, are turned like auto wheels

These remarkable photographs show the crash of a Navy monoplane, piloted by Lieutenant Hazelman, during a recent air meet at Mines Field, Los Angeles. Below: The plane careening at 150 miles an hour an instant before the crash. Left: Just as one of the wings hit the ground.



Rocket "Boosters" May Start Big Planes—Extra Wing and Oil Motor Mark Advances in Aircraft

ROCKETS as taking-off aids for heavy planes are forecast by recent successful experiments with this novel type of propulsion in Germany, observers say. A big airliner requires twice as much power to get off the ground as to cruise once it is in the air, according to experts; and rockets to supplement the propellers' traction might boost the plane quickly to flying speed, permitting a short run instead of a long one before taking wing. Fanciful reports of building so-called "moon rockets," it is pointed out, may actually veil such serious plans to revolutionize heavy commercial and war planes.

Great public interest was aroused by tests a few months ago, in which Herr von Opel, German designer of a rocket-propelled automobile, flew a large model airplane also propelled by rockets. He and other designers propose variously to apply the idea to man-carrying craft capable of crossing the Atlantic.

"Extra Wing" Lifts More

THROUGH his invention of an "extra wing" that can be attached to an airplane without altering its design, H. D. Fowler, chief engineer of a New Brunswick, N. J., company, claims that planes may carry double their normal load in passengers or freight without sacrifice of cruising speed. The Fowler wing, a long narrow flap at the back of the main wing, is adjustable. It can be extended to supplement the wing area when taking-off, and drawn in beneath the wing for fast cruising. Its extension by the pilot who operates it in flight from the cockpit, is said to provide safe control in case of a stall.

In recent tests at Pitcairn Field, Philadelphia, a Canuck light plane equipped with the device took off with full load in nine seconds, in practically still air. Observers declared that the invention in no way interfered with normal operation of the ailerons, or the plane's balance, in fact, the pilot could fly hands off the controls, with the auxiliary wing either folded or extended.

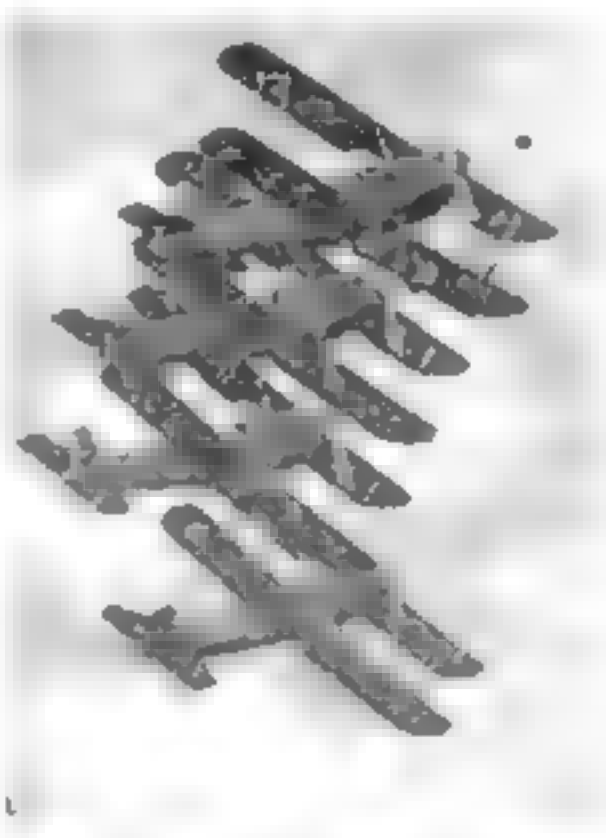
New Oil Motor Tested

MASS production of oil-burning motors for airplanes may follow recent successful tests of a new 200-horsepower Diesel type engine developed by the Packard Motor Company. In a demonstration at Detroit, Mich., it drove a commercial monoplane successfully. The new motor practically banishes fire hazard, its designers declare, by replacing inflammable gasoline with heavy oil.

Not long ago the National Advisory Committee for Aeronautics demonstrated at Langley Field, Va., a one-cylinder experimental model of an oil motor of this type. It developed one horsepower for every three pounds of weight, comparing favorably with the lightness of standard gasoline motors. Now the same power is claimed for the Packard motor, a multi-cylinder, radial, air-cooled type, fully developed for airplane use. If further ground and air tests are successful, the new motors may be turned out in quantity.

Bombing Fleet Too Late

WHEN nine huge Army bombers flew from Langley Field, Va., to Mines Field, Los Angeles, not long ago—the largest fleet of its kind ever to cross



YOU look up to see a flock of Army planes, in flying formation. With astonishing control and precision they speed, wing to wing. They tell, better than words, the thrilling story of progress in the air since men first flew, a quarter of a century ago.

On these pages each month, POPULAR SCIENCE MONTHLY aims to help you keep pace with this progress, by reporting the latest news of the sky in an interesting way.

the country they proved commercial airports en route wholly inadequate in time of war. Had the air fleet been rushing to defend the west coast against naval invasion, it would have arrived too late.

Irksome delays were experienced, pilots said, because most fields lacked adequate stores of gasoline and pumps to load it. "Many stations fuel planes from an ordinary auto filling pump—but a three-ton bombing plane cannot be moved about so easily," one reported.

Train Flying Weather Men

HOW to forecast flying weather is being taught in an advanced course in meteorology at the Massachusetts Institute of Technology, Cambridge, Mass. Dr. Carl-Gustav Rossby, a Swedish meteorologist, has charge of the class. Dr. Rossby was formerly chairman of the committee on aeronautical meteorology of the Daniel Guggenheim Fund for the Promotion of Aeronautics. Now that metropolitan newspapers have begun publishing daily Weather Bureau predictions of flying conditions in connection with the regular weather reports, the demand for men with special training in this branch of meteorology is increasing.

Another innovation in education is a school for explorers, said to be the only one of its kind in the world, founded by Dr. A. Hamilton Rice, of Philadelphia, who headed a recent airplane expedition into Brazilian jungles. Geographical surveying and field work are stressed.

Canada-Mexico Air Lines

TWO international air lines, preparations for which were announced last month in POPULAR SCIENCE MONTHLY, are now in operation. Mexico and the United States are linked at last by a new route from Mexico City to Nuevo Laredo, on the border, connecting through a Laredo-San Antonio, Texas, spur with all the air lines of the United States. Canada is tied in with the great hook-up by the Canadian Colonial Airways' line, just opened, between New York and Montreal. Both mail and passengers are carried.

Opening of the Mexican route is a triumph over extraordinary handicaps. Its path, which follows the Mexican National Railway through rugged and mountainous country, had never before been surveyed for regular flying.

Air mail for Canada should carry five cents postage for the first ounce, for Mexico, twenty cents.

A New Map for Navigators

THE latest way to represent the curved earth on a flat piece of paper aids flyers to navigate. It is a new type of map, devised by Bradley Jones and R. K. Stout of the Instrument and Navigation Unit, U. S. Air Corps, primarily for use with the radio beacon.

For all its imposing name of "equidistant zenithal projection," the new chart is simply a miniature of a huge imaginary flat card touching the earth at Wright Field, Dayton, O., with points on it that mark every neighboring city directly beneath them. The result is a map that shows accurately the direction of every city within 1,000 miles of the field, as indicated by a radio compass.

Anywhere by Air Taxi

IN A hurry to get somewhere—anywhere in the United States? Just pick up the 'phone, and call an air taxi.

That is the program of the Curtiss Aeroplane and Motor Company, which is preparing to establish air taxi service in twenty-five cities throughout the United States. It is said to be the first concerted attempt to establish an air taxi organization nation-wide in scope.

You Can Look at Your House Before You Build It!

By JOHN WALKER HARRINGTON

AT FIRST glance the latest advance in architectural science, described here, may seem like magic. But actually it is very practical and extremely useful. Mr. Harrington explains in simple, nontechnical language a fascinating new method of house planning which may save you many dollars and much worry when you build that home of your own.

TODAY thanks to the latest devices of architecture—when you plan a home of your own, you can see that house of your dreams before you build it, standing complete, with all its trimmings and adornments. Long before the foundations are laid or the first spadeful of earth has even been turned, you can inspect it on the very street and lot you have selected for its site.

You see it in photographed models, surrounded by the trees, adjacent structures, or other features of the thoroughfare where it will stand. It appears exactly as it will when finished, with its true dimensions and relative proportions to its environments. All of its attractions, as well as its possible disadvantages, are clearly and unmistakably presented.

This latest development in architecture enables any prospective house builder to inspect an entire series of such photographs, from which he may finally select the exact plan that he and his family like best. And mind you the realistic image is not merely a photographic reproduction of an architect's sketch—a "rendering" as it is called in the profession.

THEN, how is it done? What seems to be a picture of an actual, three-dimensional structure, is a cleverly scaled photograph of a miniature model of the projected home, superimposed on a camera "shot" of its future setting.

Few persons can tell how a house will appear merely by looking at the architect's plans. Drawings, blueprints, even sketches may confuse and mislead the layman.

The untrained eye cannot vision the three dimensions merely by looking at lines and curlycues on the flat surface of tracing or blueprint. Least of all can it see how a mass of brick and wood and metal will look on a site, with its steps, paths, lawns, shrubs, and trees, or as compared with adjacent buildings or as related to a street or roadway.

That is why an increasing number of architects are working out models or miniatures of houses in clay, wood, or pasteboard "in the cube," as they say. After the prospective builder has approved a rough model, the formal plans, necessary for the estimate and guidance of the contractor, may be made, and from these a model with more details can be prepared, if needed.

The principle on which this method is based was first introduced in the erection of a skyscraper. Helmle, Corbett and Harrison, architects of the Bush Building in Forty-second Street, New York City, first made a photograph of the city block in which was the site. The camera stood on the roof of a building across the street, about 300 feet distant. A photograph of the model of the building was then pasted on the photograph of the site. A little [illegible] work and the [illegible] pasted photograph of the Bush Building seemed to appear in actuality.

Small model of the home at the right, made from plans before construction.

The same idea was used by these architects in showing how the Asa Bushnell Memorial at Hartford, Conn., would blend with the locality selected for it, although its foundations were not yet dug.

Since large office buildings yield a greater revenue if pleasing and conspicuous, much care is taken to be sure they will present an attractive appearance. A large insurance company, for instance, recently decided to change the plans for its new quarters when half the steel work was up, and at tremendous cost.

It is fully as important, if not more so, that homes be built in harmony with their settings. If the sites chosen are level, one can judge the effect by affixing a photograph of a model to that of the site. Sites should be "posed" from an elevation of ten to twenty feet, and the models from the same relative angle from the camera so as to include the roof. Some wealthy men, before erecting large country houses, get airplane views of the site with the surrounding landscape and community.

THIS new idea shows many things not apparent from a drawing in perspective. A clever draftsman can make a colored sketch showing a house against blue sky and white clouds and hemmed in by trees and bushes, but it will lack the feeling of reality present in even an amateur's photograph of a model. An artist, by a deft touch, can conceal a fault, but a model cannot hide its shortcomings. A pretty picture, a product of [illegible] something that cannot be [illegible] if so, at prohibitive cost, the draftsman will [illegible] the essential facts.

The camera, however, tells the truth. It can show, for instance, that a bungalow will be an eyesore on a small lot, if built flush with the street. One of the worst examples of a house unsuited to its site was the French chateau of a wealthy New York family on Fifth Avenue, bounded on two sides by paved streets and with only a pocket handker-

The actual completed dwelling. Notice that the owner, after studying the model, decided to change the location of the garage to the opposite side.

chief lawn in front. Had it been built on rising ground in the midst of a park it would have had beauty and dignity.

As far as possible, the up-to-date architect adapts the form of a house to the natural features of a lot. If the land has a mound, or a large ledge of rock, or trees, he will not have it dug up, leveled off, and shaven clean, as was once the practice. On a ledge he may have a sun parlor; or he may use a slope as a terrace, or a hollow as an approach to a garage. The number of architectural styles is limited. By taking advantage of the unusual character of the terrain, however, the architect can design a house which will be very distinctive.

Visualizing a future house down to the last shrub, Karl Buchenel, miniature artist of Los Angeles, puts the finishing touches on a model. This new method saves costly changes.

HOUSE and lot are really one. If the model does not suit the site, it can be changed, likewise the site can be adapted. If the lot is like a billiard table, it can be made more attractive by a terrace approach.

One of the best examples of the new method is a residence on the outskirts of Dayton, Ohio, recently completed for R. T. Gardner under the direction of his New York architects, Peabody, Wilson and Brown. Before ground was broken, heavy timber boxes were built about the trees near the site, to prevent their being barked or grazed by trucks and steam shovels. A large clay model was made, showing the house as planned, the grounds slightly changed in grade about the house. As completed, this house in the woods near the Park road in "The Gem City" is in complete harmony with its sylvan surroundings. The same method employed in its construction can be applied, of course, to dwellings of moderate cost.

One may see how flat lots have been changed to make them more picturesque by making a tour of recent suburban developments in Westchester County and Long Island, New York. The original models were made with settings of slope and foliage and with trees, which were to be added. So closely were these ideal homes and sites reproduced that it is hard to detect which are photographs of mansions in miniature and which of the actual completed structures.

Real estate companies now have offices which might be mistaken for stores for the sale of doll houses. On tables and shelves are small scale models of homes. Customers can make their selections from the samples, and see airplane views of the property and close-up photographs in which lots appear. If the prospective purchaser wishes, he can have a photograph of a model placed on a site picture, or go a step further and see the whole scheme worked out with model and setting.

WHEN one is thinking of moving to a region under development, he likes to know what kind of houses his neighbors will have. Corporations, therefore, assemble large models of entire communities—highways, streets, yards, houses, churches, stores, and also a model of the vicinity. Such have been used as exhibits before town boards as evidence of what a new settlement is to be.

After an architect's client feels he will be pleased with the general appearance of a house and with its environment, exact details are in order. So skilled are many architects in making rough models that by putting calipers and compasses to them, they can get measurements for the formal plans. Contractors hitherto have followed blueprints in making bids on erection, but now they ask to see the models as well. Accustomed as they are to "reading plans," they get a much clearer idea of the work to be done by studying it "in the cube," on the inside as well as on the outside.

Scale model accurate in every detail was made from plans for new memorial building at Hartford, Conn. It even shows a bus in front

The architect's photograph of the site for the new memorial

The photographed model, superimposed on the photograph of the site, reveals exactly how the completed structure will appear on the selected location and how it will harmonize with surroundings.

In designing a country home for Mr. and Mrs. Henry Esberg, near Purchase, New York, the architect, Frank Eaton Newman, at first utilized a model carved from plaster to get the general effect of mass or bulk. In this he was guided by an unusually good airplane view. Next a model was fashioned on which all details, doors, windows and ornaments were indicated. The completed miniature structure as developed by Walter Pavreau, of the Artop Model Company, was then photographed at different angles. Certain changes both in the house and in its position were then made, based on the preferences of the clients. This model was more elaborate than the types commonly prepared. Yet, considering it paid for itself several times by saving the cost of changes which would have been made in the finished residence, it was a good investment.

ALL the thought given to a complete model yields practical results. Instead of telling his client that this line is a wall, that dotted circle a door, and that dowdah an electric light outlet, the architect shows a standing three-dimension interior. Many models are so complete that when (Continued on page 136)

Recent Advances in Science

Cathode Rays Put to Work

WHAT good are cathode rays? That was the question hard-headed critics proposed when Dr. W. D. Coolidge, of the General Electric Research Laboratories, announced that chemicals underwent strange changes, and minerals glowed with fluorescence, when exposed to rays from his powerful new cathode ray tubes. The first of these was a glass vessel that shot a stream of "electron rays" through a three-inch window of metallic nickel film. The second coupled three tubes to "kick" along the rays to a final velocity of 130,000 miles a second.

German investigators asked the same question, and Prof. H. Plauson of Hamburg, Germany, devised a new cathode tube resembling Dr. Coolidge's, but substituting a window of gold-plated beryllium, another metal, and using only two thirds the electric voltage; also supplementing the tube with magnetic effects.

With it, Prof. Plauson recently announced, he can make ammonia from a mixture of nitrogen and oxygen. He claims he can make synthetic rubber with astonishing rapidity, can harden liquid forms of bakelite into solids without heating, and from coal, air, and water, can manufacture alcohol, methanol, acetic acid, and ether.

Monsters Unearthed

HEAD bones of a huge prehistoric monster just unearthed by Roy Chapman Andrews at the southern edge of the Gobi Desert indicate, he says, that the original animal was as long as the height of the world's tallest building, the 792-foot Woolworth Building in New York. Every time the monster turned around, his front and hind quarters must have traveled a quarter of a mile. His head, of striking appearance, was evidently broad, with a tapering nose and flaring nostrils.

"We found a monster in the same area in 1925," Andrews says. "The saddle-shaped-headed creature discovered on this expedition is believed to be the great-grandfather of the 1925 monster."

Another glimpse of what formidable creatures once lived is revealed in the discovery, at Kristianstad, on the Swedish coast, of an enormous whale estimated to have lived 5,000 years ago. Workmen digging a ditch at first mistook the thirteen-foot jawbone they unearthed for a part of the hull of some ancient vessel.

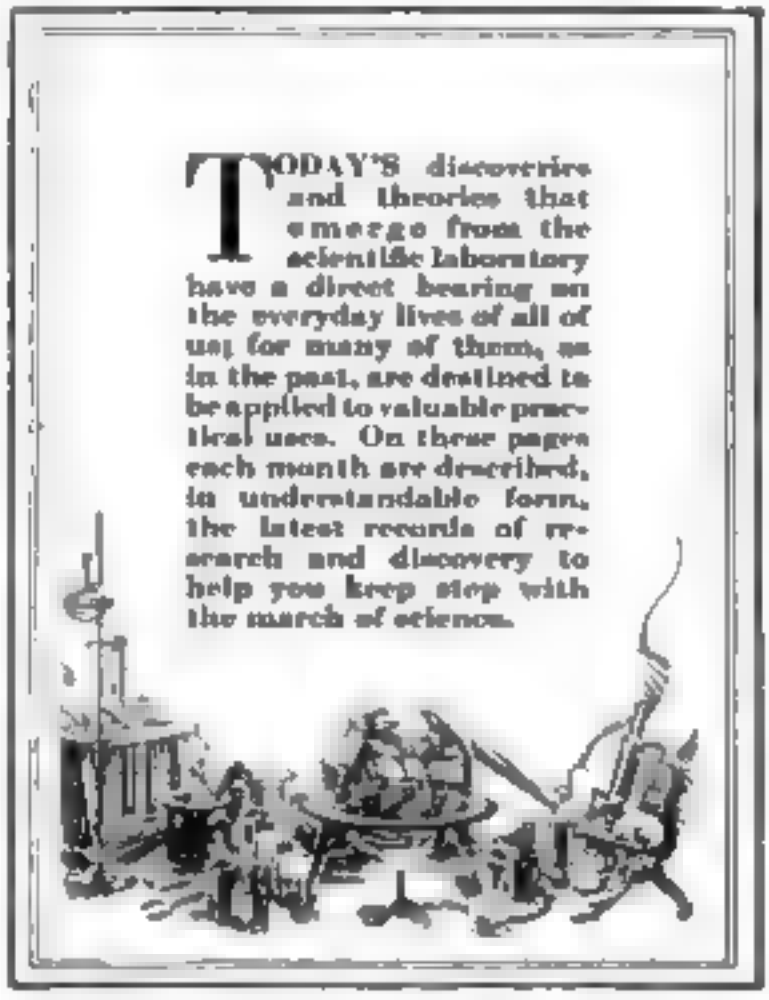
New Perfumes and Pickles

PERFUMES and pickles lie within the field of tomorrow's chemist, who may make startling improvements in both, according to experts of the American Chemical Society.

Rich and poor women alike may soon enjoy the fragrance of the rarest perfumes, in the opinion of Col. M. T. Bogart, head of the organic chemistry laboratory at Columbia University. Today in France, 40,000,000 jasmine plants growing in great fields supply only 1,700 tons of perfume extract a year—an amount that tomorrow may be manufactured in purer and better form in a single small factory and at a fraction of the cost through synthetic chemistry.

"The field of synthetic odors is limitless," Col. Bogart says. "We have developed entirely new scents. We shall even need a new language for them."

Spices and their constituent oils, first cousins to those of perfumes, may also be improved by chemists, according to another expert, John Glassford. Better pickles, condiments, mayonnaise and other dressings, he says, depend upon the study of spices in the double role of flavors and preservatives—another field in which chemistry must lead the way.



Wealth in Nitrogen

TODAY a pound of nitrogen gas—about four barrelfuls—is worth approximately thirty-two cents, while an equal weight of gold, a bar about the size of a spectacle case, commands a price of $250. Yet nitrogen may replace gold as the standard of a nation's wealth in the near future, H. R. Bates, vice president of the International Agricultural Corporation of Atlanta, Ga., recently told the American Chemical Society.

This lazy, inert, colorless, odorless, and tasteless gas, which forms the major part of the air we breathe, is of vital importance in the manufacture of fertilizers and explosives, he said. By learning to extract it from the air, industry has heeded the startling prophecy of the British scientist, Sir William Crookes—that, otherwise, starvation must follow exhaustion of Chilean nitrate fields as sources of fertilizer.

Capturing Hidden Gold

WITH the solution of a problem that has baffled experts for half a century, miners are to capture gold hidden in blue ores of the Black Hills, Nevada, district. Hitherto the most rigorous treatment with heat and chemicals has only locked the gold more securely in its ore by the formation of refractory compounds; but now the Rare and Precious Metals Experiment Station of the Bureau of Mines at Reno, Nev., announces that it has successfully extracted the gold by a new process that includes a short, low-temperature roast, a wash with lime, and then the usual treatment with cyanide.

Other researches are aiding the mining of nonmetallic substances—a major part of the United States' seven-billion-dollar mining industry. New wire saws, described not long ago in POPULAR SCIENCE MONTHLY, are reported by the Bureau of Mines to have effected tremendous economies in slate quarrying by eliminating waste.

Stronger "Death" Waves

MORE destructive super-sound waves, vibrating at the unprecedented rate of two and a half million times a second, recently have been produced in the laboratory of Alfred L. Loomis at Tuxedo Park, N. Y. Like the inaudible, ultra-rapid waves of one third this frequency which he previously generated they kill small animals and plants placed in a vessel of water subjected to them. They destroy plants that resisted the strongest waves previously used on them.

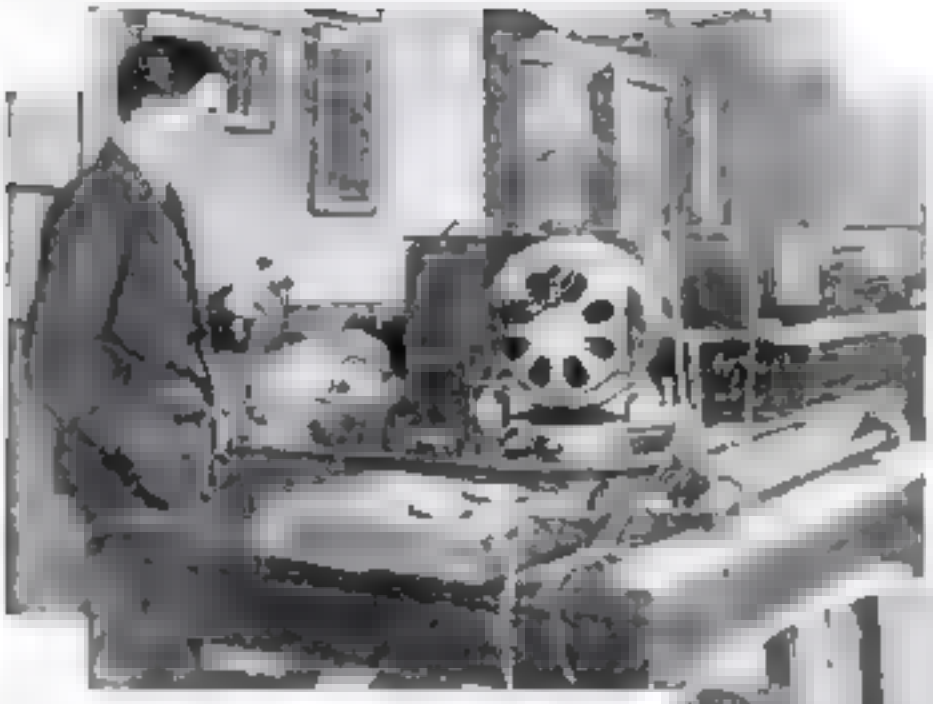
Winning Against Scourges

AT LEAST one more scourge of man seems conquered, another promises to be, and medical men the world over are fighting other dread diseases.

Prompt use of a newly developed serum for infantile paralysis stamped out a threatened epidemic last summer.

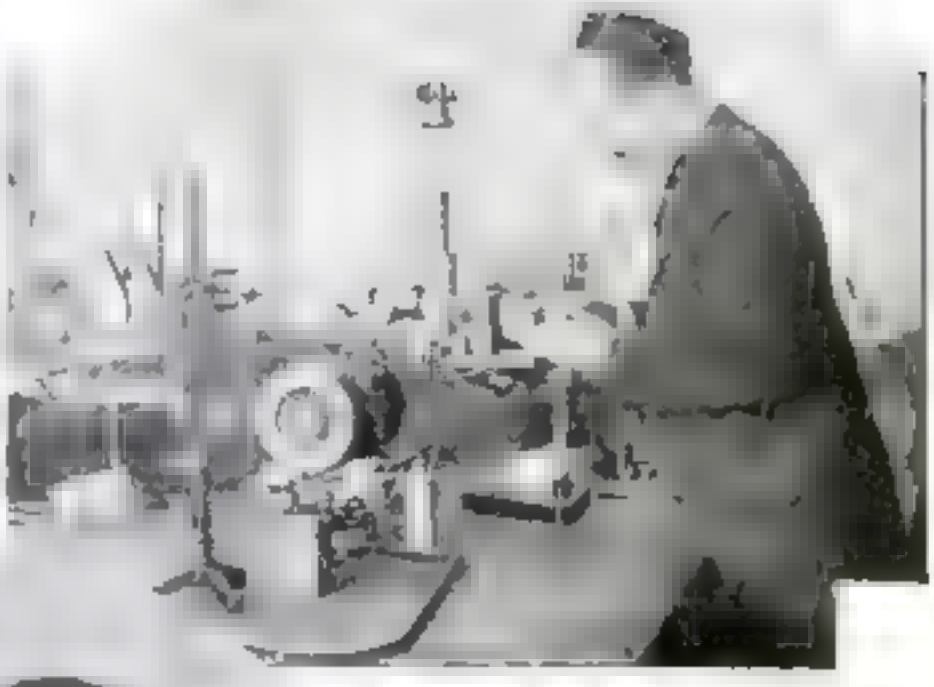
That leprosy at last may be conquered is seen in the announcement that eight more lepers have just been discharged from the National Leper Home at Carville, La., "apparently cured" and no longer a menace to the public. Thirty-seven in all have been discharged after treatment by new methods with chaulmoogra oil and its derivatives.

Meanwhile Dr. Warren K. Stratman-Thomas, Wisconsin pharmacologist, is Africa-bound to find a specific cure for sleeping sickness.



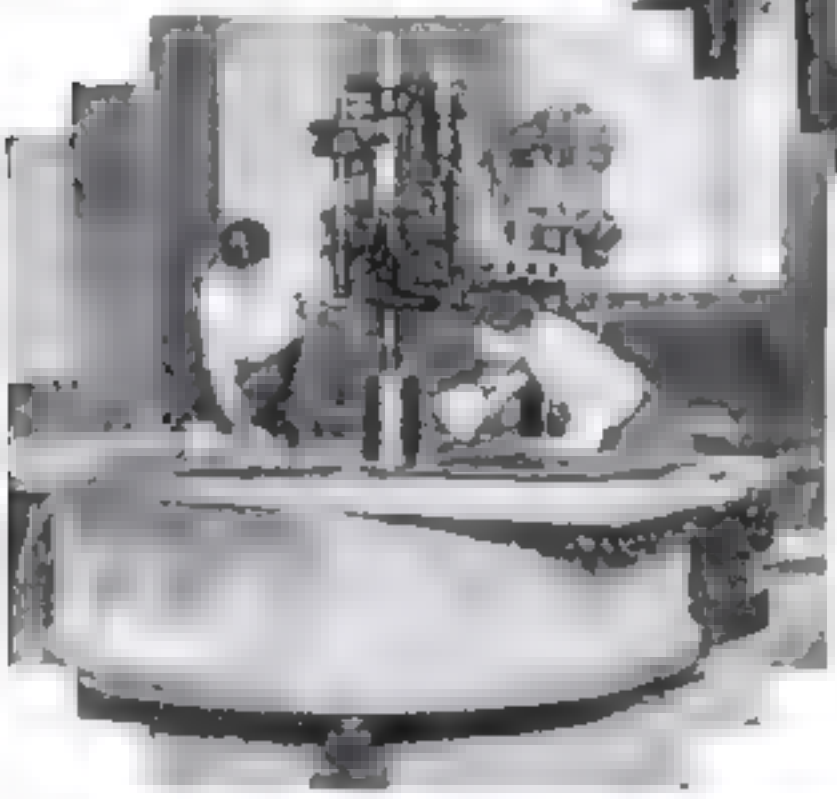
Photographs Dynamite Blasts

Dynamite explosions and streaking flames are photographed by four high-speed cameras weighing a ton, recently developed by J. Carlton H. Palmer and W. A. Bone, of the Imperial College of Science, London. The machines are triggered by electric switches, making the photographs at the moment the explosive is set off by the swift-moving projectile, which completes a circuit. The cameras are expected to reveal new facts about the action until another five hundredths of a second, or thereabouts, after the explosion. The photographs will be used in the study of how to improve armor plate.



The Blow That Kills a Germ

How much weight do you have to drop on a microbe's back to kill it? Dr. F. Howard Frey, a Roentgen X-ray expert, answers the question with the aid of an apparatus by which a single X-ray beam at low power can be focused. His tools it takes a ton with the force of blow struck by a sledge of steel, falling a hundredth of an inch. A germ, to take a fraction, is about a millionth of an ounce.



Drilling Largest Reflector

A single slip in drilling an eight-inch hole through the optical axis of this 3,500-pound, seventy inch telescope reflector, the largest ever made in America, would have ruined a year's labor. The glass disk was cast for Ohio Wesleyan University by A. N. Finn, of the U. S. Bureau of Standards, at Washington, D. C. He is seen at the right of the picture above, supervising the drilling. During the delicate process, which advanced about an inch a day, the glass was imbedded in a cast-iron form filled with sand. The workers were protected from possible explosion of the glass, due to concealed strains, by heavy planks and steel shields. In casting the huge disk, molten glass was poured into an electrically heated mold, which permitted it to cool gradually, for eight months, to average room temperature.

Recording Street Noises in London

Disturbing street noises in London, England, are to be [illegible] by the Noise Abatement Society, which has been formed by the British Medical Association to study the effects of noise on health.

Five-Million-Year Fossil

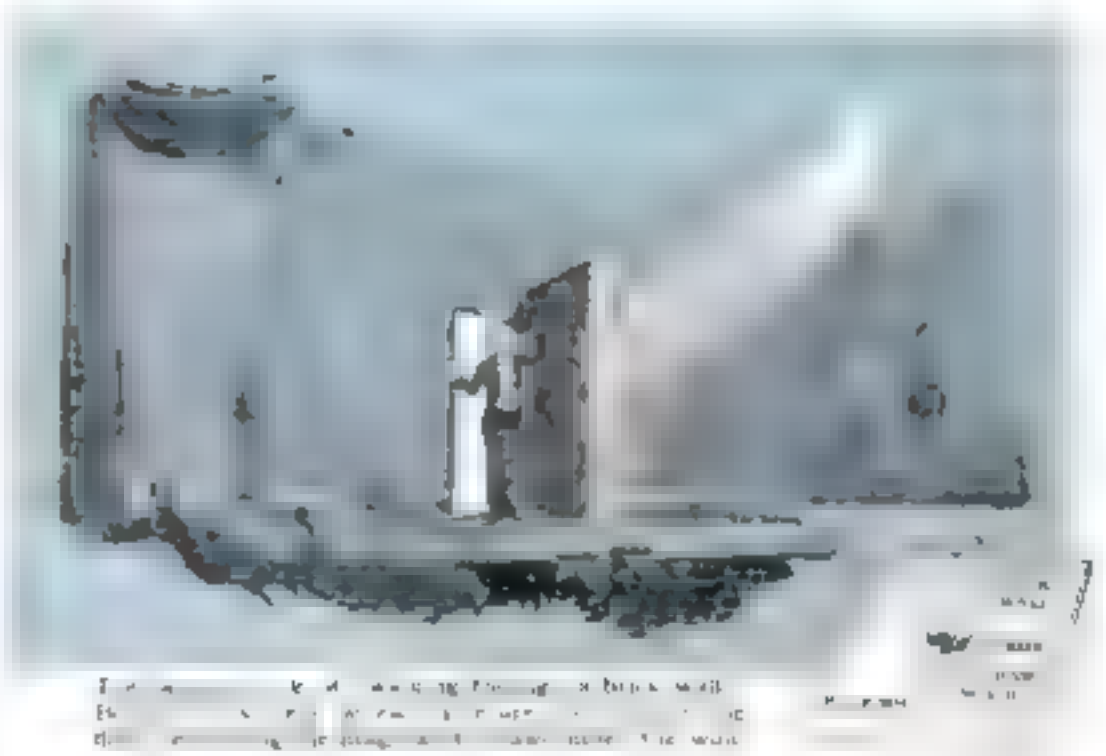
The picture at the left shows Prof. Loye Miller, head of the Biology Department of the University of California, with the fossil of a bird believed to have lived five million years ago. It was found recently at Calabasas, Calif., near Los Angeles. The prehistoric bird, which thus left its wingprints through the ages, is believed to have belonged to the family of cormorants, fish-eating sea birds. Its form has been so preserved that even the fine markings of its feathers are distinguishable. This is the first fossil specimen of vertebrate life discovered in the prehistoric formations, millions of years old, uncovered in the Los Angeles region.

How Magicians Do Their Tricks

AN EXPERT takes you behind the curtain of deep mystery and explains just what you've always wanted to know—How ingenious inventions of mechanics and science produce those astonishing stage wonders that seem impossible to the audience

By

GEORGE S. GREENE



"NOW," said the magician to an involuntary investigator, enticed to the stage by a ruse that left him wondering how it happened—"Now, with your own eyes, you saw the young lady walk into the cabinet, and 'presto,' she has disappeared. Please examine the cabinet thoroughly. You find nothing? Very good. Thank you, young man." And, as the young man was being helped down the "runway" by the courteous miracle performer, the latter whispered, offhand, "Be sure to come up again when I call for volunteers."

I was seated "down front," in the orchestra section. Surrounding me were young business men, doctors, inventors, mechanics. Men who, being mechanically, electrically, and chemically bent, probably had their cellars or garages fitted up with lathes, electrical contrivances, chemical retorts, or radio apparatus according to the spare-hour hobby in which each was most interested. They sat there with wide open eyes, mystified. They looked but they saw not. Before them, one by one, were exhibited marvels of trick mechanical contrivance; yet, thanks to the ready "patter" and adroit misdirection of the magician, they were absolutely at a loss to explain or understand how the bewildering feats of magic were performed.

Hundreds of flowers, beautiful silk flags, and a few ducks or rabbits would pour from some spectator's borrowed hat, and the consensus of opinion in the orchestra seats would be, "Aw, he gets those out of his sleeve." Yet if those mechanically minded men of the audience could step behind scenes some day and examine there the clever contrivances built to fool the public from the stage they would be surprised to learn how readily seemingly impossible wonders are performed by use of concealed hinges, fake nails, electricity, plumbing, carpentry, radio, chemistry, physics, hydraulics, metal working, and similar appurtenances of the magician's art.

How chemistry produces mystifying smoke. Pressing bulb mixes fumes of ammonia and hydrochloric acid, in hidden b[illegible], forming vapor which issues from a tube at wrist.

BUT the big problem is to gain entrance "back stage." First, a guard at the stage door inquires your business, then a large "cyclorama" curtain, surrounding the working part of the magician's stage, prevents even the stage hands from becoming too inquisitive.

I remember a young woman writer, who, some years ago, attempted to expose secrets of magic by "investigating" the prestidigitator's stage properties. In this she was quite evidently disappointed, for the only "revelation" she was able to present was a statement that "the mechanical device that causes the lady to float in mid-air is known as a 'gooseneck gimmick.'" She was quite correct, though I doubt if she understood what a "gooseneck gimmick" is, or how it is used.

THE gooseneck principle, (a "gimmick," in magical parlance, means secret device) is as old, almost, as the mystery of magic. On it depends the renowned illusion variously called "The Aga," "Floating Lady," and so on. There are perhaps a dozen ways of presenting the trick, but each depends upon the gooseneck.

The trick probably first originated in Asiatic mythology, and in the belief that in a certain part of India the casket containing the remains of a once highly revered religious leader has remained for thousands of years suspended high in the air without contact or support from anything earthly. However that may be, as presented nowadays, a young woman is introduced and the magician pretends to hypnotize her. She becomes "cataleptic" or stiff, and is placed on a couch standing near a back curtain. With appropriate music and waving of hands, the woman slowly rises into the air until she is above the magician's head, and without visible support. A really solid hoop is then passed over her body twice to prove that there are no connecting supports.

Behind the curtain near which the couch rests is placed the moving or "levitation" apparatus. Different performers use different types of mechanisms for this. A common type is a trunk with a rod passing through a hole in the

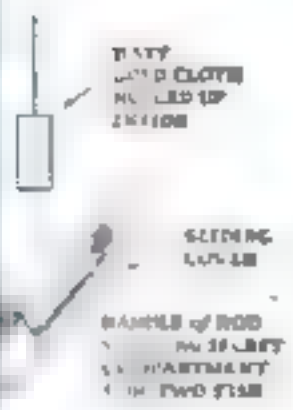
"Catching fish out of the air." A jerk on the pole releases from the "bait" a fluttering golden cloth resembling a live fish. The magician deftly substitutes a real fish which has been concealed in the handle of the rod, and throws it into the water in the fish bowl.

top. By a system of gears, when a crank is turned, the rod is forced, very slowly upward. Fastened to the top of the rod is the "gooseneck." This is a length of strong iron rod, bent to the shape of an S. It passes through a slit in the curtain and its outer end is fastened to a metal framework on the reach on which the girl rests while she is "floating" in the air. Loose clothing conceals her support and the gooseneck is hidden from the audience by her body.

The hoop of course is solid. But the thing that spectators miss is that the hoop is passed over her body *twice*. First it passes over the feet, then the head, and is brought around the curve in the gooseneck so that it circles the iron rod. It is again passed over the feet, then over the head, which frees it from the gooseneck so that it can be passed to the audience for inspection or rolled "off stage." Were it not for the curves in the iron support, the trick would be impossible.

FOR variation, the girl sometimes is covered with a sheet, and when the sheet is jerked away while she is in the air, the girl has disappeared. The couch is made so that when she is about to be covered with the cloth, she can open an entrance to the couch and slip inside, entirely concealed. In her place under the sheet is substituted a black piano-wire form of a girl which comes from behind the couch, and it is this wire form which is "floated" in the air by the goosenecks. When the cloth is jerked away the black wire form is invisible against the background, and curtains are lowered quickly lest it be discovered by a too observing spectator.

One performer made a practice of inviting members of the audience to the stage to inspect this trick. By appropriate misdirection he prevented any investigator from learning the secret. Immediately the sheet was jerked from the form, he would have the curtains closed by assistants. One night a man who was among these spectators seemed nervous and especially interested. When the signal was given to close the curtains he rushed toward where the girl had apparently vanished, and the curtains closed between him and the audience. It developed that the man was the husband of the girl used in the trick. She had left him to "go on the stage"; and when the husband thought he saw her "vanish" he rushed frantically to the invisible wire form. The couple were reconciled and the magician advertised for a new lady assistant.



In the last three centuries countless small appliances as ingenious as the gooseneck have been developed as indispensable adjuncts in the presentation of mystifying illusions and tricks on the stage.

Of these, perhaps the "servante" is the most used. This is a device to receive and hide discarded cards, oranges, rabbits, handkerchiefs, and the like. One type fits on the back of a chair, forming a pocket into which the contents of the magician's hand may be discarded while to all appearances, he is simply moving the chair. Then there is the "table servante," a special table top covered with black velvet which is marked off with gold braid into squares or circles. [illegible] the table beneath these openings are cut away. Black bags are [illegible] so that as the magician picks up a small [illegible] the contents of his hand may be dropped into the invisible opening, or trap as it is called professionally. These traps are [illegible] and replaced under cover of a trick in which the magician must [illegible] yards of yards of torn paper [illegible] for which [illegible]

One of the very few instances in which a professional magician uses his sleeves for disappearances is that of making a handkerchief vanish. The performer wears on his left wrist, as you or I would wear a wrist watch, a small round box resembling a pill box. Inside this is a powerful spring, like a clock spring. It is connected to a strong cord, which passes under the coat, into the right sleeve, and terminates in a hook at the right wrist. The hook is usually fastened temporarily to a finger ring on the right hand. Fastened to a handkerchief, it pulls the latter up the right sleeve in a flash invisible to the eye. Some of the spring "pulls," as they are termed, are fitted with a device that holds the spring until a button is pressed with the finger, or against the body, when the spring flies into action.

ABOUT twenty years ago a European magician caused a sensation with a trick that is absurdly simple to anyone acquainted with chemistry. His dress and makeup resembled the popular conception of the devil. He astounded his audiences by producing puffs of smoke anywhere he desired, with bare hands. Spectators carried glass vases to him, and at his touch the jars would fill with smoke, without the faintest sound of explosion. Some credulous persons actually believed that the smoke was produced from the "lower place." The secret was never revealed to the public, but among magicians

The mysterious "floating lady." She is really suspended in the air by an S-shaped iron bar called a "gooseneck gimmick."

it was known. In his left sleeve was a rubber bulb, connected with a tube that passed down the right sleeve. In the sleeve the tube led to two bottles, one containing hydrochloric acid; the other, liquid ammonia. The bottles, in turn, were connected by glass tubing which pierced their rubber corks. When the rubber bulb was pressed, air was forced into the ammonia bottle, causing ammonia fumes to mix with those of the hydrochloric acid, and so producing a white chemical smoke, which issued from a slender tube at his wrist

A FEW years ago a famous magician with a fancy for large illusions invented what is now known as "Walking through a Brick Wall." It was immediately a sensation. As the curtain rose, the audience saw a large square wood frame, on rollers, and a large pile of bricks. A man dressed like a bricklayer placed the bricks in position in the frame, making a solid brick wall. The cross section of the wall faced the audience, and at each side, near the center of the wall, a screen was placed. The performer went behind one of the screens, and while a committee was surrounding the stage he apparently walked through the wall for he quickly appeared from behind the screen on the opposite side of the wall.

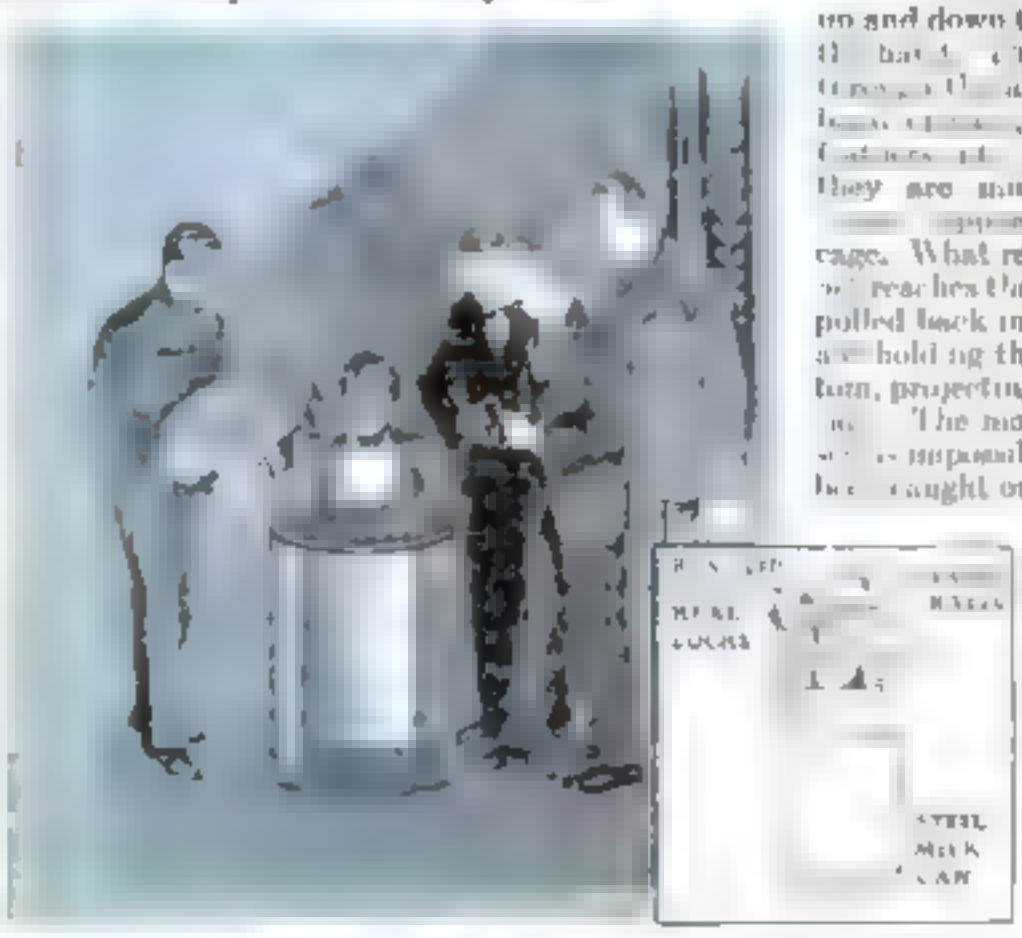
It was a real brick wall, sure enough. But on the stage floor was a small carpet, which concealed trapdoors in the stage. The performer merely required an assistant to open the trapdoors, allowing him to crawl underneath the wall and up to the other side.

AT ONE time conjurors were notorious among theater managers for "cutting their stages to pieces" with trapdoors. Nowadays, however, many stages have concrete floors, so the practice of cutting "traps" is almost obsolete.

Illusions in which the element of possible death is present have always been popular, although usually there is little danger to the performer. The milk can escape is an example. To the layman, it would seem physically impossible to escape from a can filled to the brim with water, the lid being locked on with borrowed padlocks.

Here again, the work of the expert metal smith does the trick. The can is so made that on examination it appears untampered with. It is filled with water, the magician, wearing a bathing suit, steps in and draws his head down into the water. The lid is quickly locked, and the can surrounded with screens. The magician, however, has merely to push up on the lid, and a top part of the can, consisting of a false shoulder, lifts up to allow escape. It is necessary to hold the breath under water for only a minute. When the lid is replaced everything is as before, and the examining committee from the audience find the sealed locks intact and untouched!

How the vanishing handkerchief is drawn up into the right sleeve by a hooked cord from a spring on left arm.



Dressed in the milk can? Hardly. The magician lifts off the thick top, padlocks and all, as shown in the drawing at right

THERE are two important tricks in which live birds and fishes are used. One is known as "Fishing in the Air" and the other "Dove Catching in the Air." In the former, the magician, with rod and line, catches live goldfish from the air and deposits them in a bowl of water, where they can be seen swimming about. In the latter, a pole with a net at the end is used, and live, white doves are seemingly caught in the air above the audience and deposited in wire cages, where they are very much alive.

These, again, have been made possible by mechanical genius and inventiveness. The handle of the fishing rod contains concealed compartments for two live goldfish, with wet sponges to keep them alive. The "bait" consists of a tiny metal tube stitched to the fishhook. Inside of the tube is a shred of golden-yellow silk. When the performer jerks on the pole, the golden silk is jerked out of the tube automatically, and being kept in motion, it looks for all the world like a flapping goldfish. As the performer grasps the piece of silk in his hand to remove it from the hook, he deftly substitutes a live fish from the handle of the pole, then drops the live fish into the bowl.

The "Dove Catcher" is a brass tube about five feet long, with a wire hoop and net at one end. Inside of the tube, at the net end, are a few white feathers fastened to a metal rod, which passes down the tube and connects with a metal band sliding up and down the outside of the tube near [illegible] the performer waves the net [illegible] air, and, moving the sliding [illegible], quickly forces the white [illegible] the net. While in motion they are mistaken for a dove. The [illegible] apparently is dumped into a wire cage. What really happens is that, as the [illegible] reaches the cage, the fake feathers are pulled back into the tube, and an assistant holding the cage releases a false bottom, projecting a live white dove into the [illegible] The movement is so quick that it [illegible] impossible that a real dove has not been caught out of the air.

An expert sharpshooting artist of Europe once was approached by a young man who proposed a novel publicity scheme which, he said, would make the sharpshooter famous. The two formed a partnership and both became wealthy. The novelty was this: The young man, holding a Japanese umbrella in his hand, climbed to the top of a stepladder. There he momentarily covered himself with the umbrella. The sharpshooter fired at the umbrella, which dropped to the stage floor, the young man having vanished. Not until the death of the inventor was the secret learned by other magicians. A figured background was used, and a piece of the same material was fastened as a screen across the back of the stepladder so that the audience apparently saw the real background through the ladder. When the sharpshooter fired, the young man simply dropped down behind the ladder, and the screen of background material tacked to the ladder hid him from view.

PERFORMANCES of tricks in which magicians use ingenious mechanical contrivances offer an opportunity for mechanically, scientific minded men to study and try to fathom the wonders that are employed to entertain and mystify. I have given here only the barest outlines of some of the most noteworthy illusions. In another article I will give the details of other familiar tricks.

You can have two guesses to explain how a magician can tell which card you pick from this "forcing deck." You guessed it

"Fighting Jack" Kenlon inspecting a Paris alarm box during his recent trip to Europe to study fire-fighting methods.

Killing Fires High *in the* Air

By

HENRY MORTON ROBINSON

MORE thrilling experiences from the life of John Kenlon, New York City's veteran fire chief. "The best way to fight fire is to prevent it," he says, "and the next best way is to starve it to death." In this fascinating article he tells of modern scientific methods and devices which smother flames before they get a start, and prevent conflagrations.

Off duty, the veteran chief, like any normal citizen plays golf and enjoys other recreations which keep him fit for the big job of mastering the fire demon.

IMAGINE a steel blowtorch twelve feet wide and five hundred feet high, spouting a solid jet of flame into the interior of a $16,000,000 modern office building! Imagine that flame developing a temperature of 2,400 degrees as a furious draft sucks it upward. And finally, picture the condition of the building after that blowtorch had roared through it for six hours!

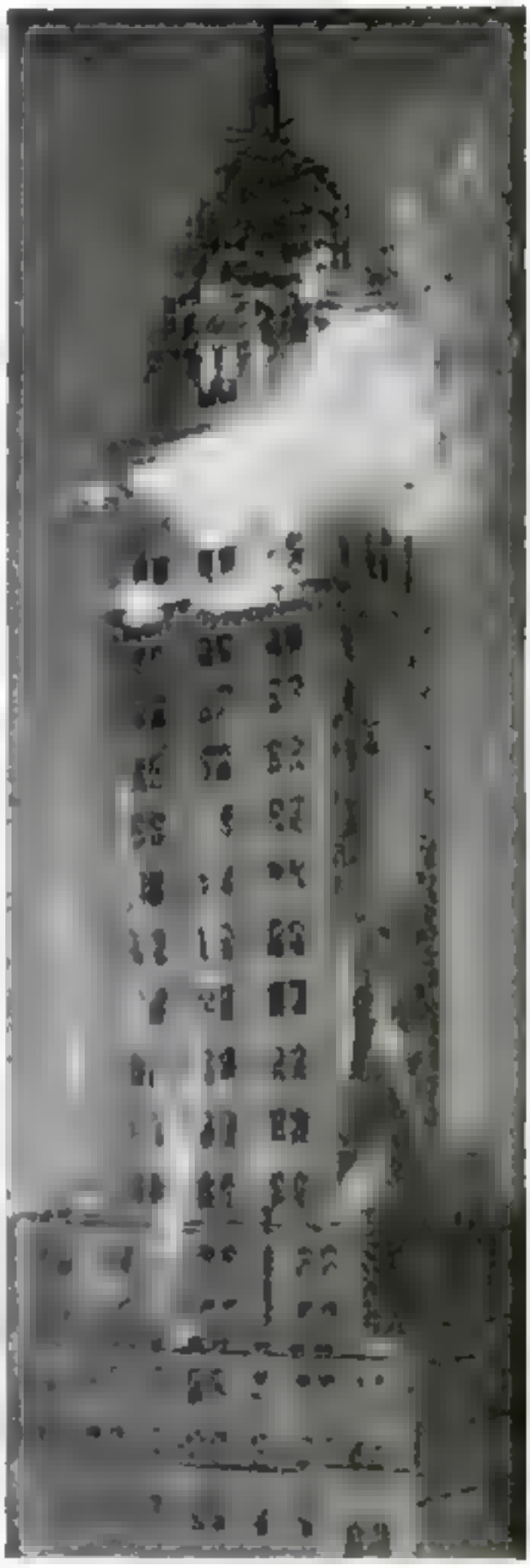
A wreck of twisted steel? A pyre of smoldering ashes? Fortunately, neither. Merely a filing cabinet destroyed, a few desks burned, some fireproofing chipped off a single office—and the total damage not exceeding $25,000! That, in brief, is the amazing consequence of the second Equitable fire in New York City—a fire which dramatically proved the assertion of John Kenlon, the city's veteran chief, that "the best way to fight fire is to prevent it; the next best way is to starve it to death."

Fire prevention and fire "starvation" are the two major chapter headings in the science of modern fire control. Or to put it in terms of John Kenlon's life story, they are the dominant factors in his seventeen years' experience as chief of the New York Fire Department.

WHEN the first Equitable Building burned to the sidewalk in 1912, it became apparent to Kenlon, just entering upon his career as chief, that the old ideas of "fireproofing" would have to be abandoned. He determined that a new technique of fire-resistive construction would have to be devised. As the Fire Department member of the Board of Standards and Appeals—the body that dictates building legislation in New York—Kenlon laid down his specifications for the "Standard Fire Resistive Building of the Highest Type." They called for a building that would resist a temperature of 2,000 degrees Fahrenheit for four hours without material injury to its structural parts. The new Equitable Building on lower Broadway, rising out of the ruins of the old one, was built in close conformity to Kenlon's specifications. And it was these that made it possible for the new building to resist the fire which broke out at three A.M. on February 16, 1928.

THE fire started in a twelve-by-twelve-foot pipe shaft, extending from the basement to the roof, and containing the main steam, gas, and water pipes that supplied the building. A bursting water pipe brought a midnight crew of plumbers, carrying a portable electric light, to make repairs. They entered the shaft through a fire door on the thirty-fifth story and after working a while discovered a fire in the bottom of the shaft. A short circuit in the portable electric cord probably ignited the felt covering of a steam pipe. The heat generated by this flame caused the twisting and breakage of an uncovered six-inch gas pipe, which shot a roaring tower of flame up the shaft and through the fire door on the thirty-fifth story, left open by escaping workmen.

The blazing gas quickly filled the thirty-fifth floor and began to devour the contents of the unprotected offices. A few pieces of furniture



The spectacular Sherry-Netherlands blaze of 1927. For ten hours it raged unchecked in the thirty-eighth story scaffolding of the partly built hotel.

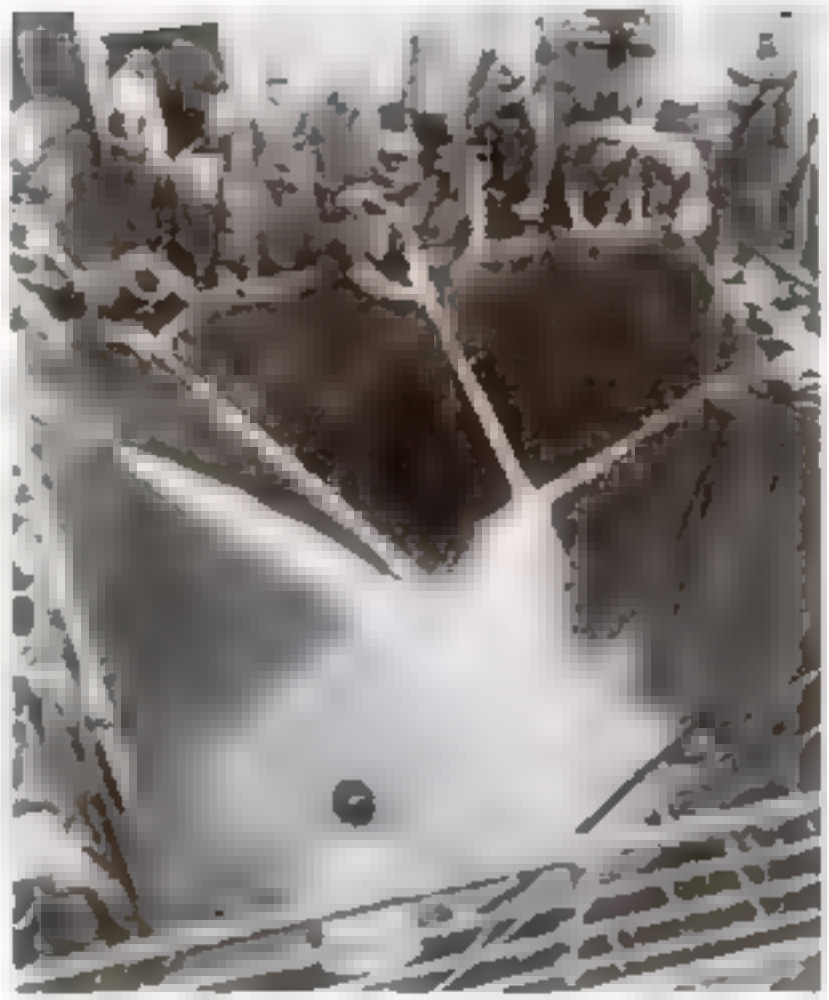
were quickly consumed, and the Fire Glutton decided to attack the building itself. *But what was there to attack?* Licking its evil lips hungrily, the Fire Glutton could only twist helplessly around concrete-covered steel columns, hollow-tiled walls, and wired-glass window frames. And when firemen at last sealed the broken gas pipe by a deluge of water poured into the shaft, the fire died of boredom and undernourishment. Or, as Kenlon said "It was starved to death."

CHIEF KENLON called this second Equitable blaze "the highest fire in the history of the world." How, you may ask, did he force effective streams of water 550 feet into the air, to quench a fire in the thirty-fifth story? He didn't. There isn't an engine in existence that could pump a fighting stream that high—or a hose that could stand such pressure. But, following his own specifications for a model building, the Equitable had two 12,000-gallon tanks on the forty-first story, and was also equipped with two eight-inch standpipes with a pumping capacity of 6,000 gallons a minute. Kenlon merely ordered his men to connect the house lines to these outlets, and the fire was under control (except in the pipe shaft) within an hour.

"Reserve tanks and standpipes running from cellar to roof are essentials in skyscraper fire-fighting," said Kenlon after the fire. "Without these two weapons, firemen are helpless. No water tower is effective above the fifteenth floor, and hose lines cannot be dragged much higher.

BEFORE Kenlon will O.K. any skyscraper as a reasonably protected hazard, he personally inspects the tanks and standpipes. Architects and engineers know him as a "tough hombre" because he frequently insists on extensive changes in the size and location of the interior water supply.

The spectacular Sherry-Netherlands blaze, which on April 13, 1927, raged unchecked for ten hours in the thirty-eighth story scaffolding of a nearly completed Fifth Avenue hotel, furnished New Yorkers with a taste of the ultra-theatrical in sky fires. It also gave specific point to Chief Kenlon's contentions about buildings in the process of construction. After the Commodore Hotel fire of 1924, which threatened the Forty-Second Street business district and proved that the "almost finished" building is an especially dangerous fire risk, Kenlon urged that "fire-elevators," encased in fireproof shafts, should be put in operation as soon as the steel skeleton of a building was erected. These elevators, for fire use only, could quickly boost firemen and chemical apparatus to the source of a blaze. In the construction of the Sherry Netherlands Hotel this provision apparently was neglected. As a result, the Fire Department was faced by an uncontrollable blaze in a partially completed building, without fire elevators, tanks, or standpipes.



The enormous waterfront and shipping of Greater New York add to Chief Kenlon's problem. Here firemen are seen pouring streams into the blazing hold of a vessel, following an explosion

A SINGLE fireman with a forty-gallon chemical tank could have gone up on the elevator and extinguished that fire at any time during the first twenty minutes, "declared Kenlon. "But see what actually occurred. We had to climb thirty-eight stories—nearly the height of Washington Monument—carrying heavy apparatus on our backs. By the time we reached the fire we were extremely fatigued, the fire was beyond the reach of chemical apparatus, and needed 4,000 gallons of water a minute. But neither the standpipes nor the reserve tanks were available. The building was outside the high pressure area, and the nearest hydrant was 100 feet away from the burning side of the building."

The New York Fire Department, hailed as the greatest in the world, suddenly seemed antiquated and futile. Unbelievable as it sounds, *the nearest water was fully one third of a mile away!* For six hours Kenlon hovered over the brink of humiliating defeat while rocketing embers from the burning hotel were scattered over roofs and terraces of neighboring buildings. But with its usual good fortune, New York was spared a serious conflagration, the fire burned itself out at last, and the Sherry Netherlands blaze passed into history as one of the few great "waterless" fires on record.

KENLON resolved never to be caught again in such a predicament. He immediately demanded a meeting of the Board of Standards and Appeals, and proceeded to shake that body into effective action. No one knows what he said at that meeting, but it is known that the inspector of buildings was tremendously busy during the next month. Fire elevators and temporary water tanks were promptly installed in every partially finished building and the extension of the high pressure system to Fifty-Ninth Street (long a favorite project of the chief) is soon to become a reality. If Kenlon has his way—and he will—the near-tragedy of the Sherry-Netherlands will never be reenacted in New York City.

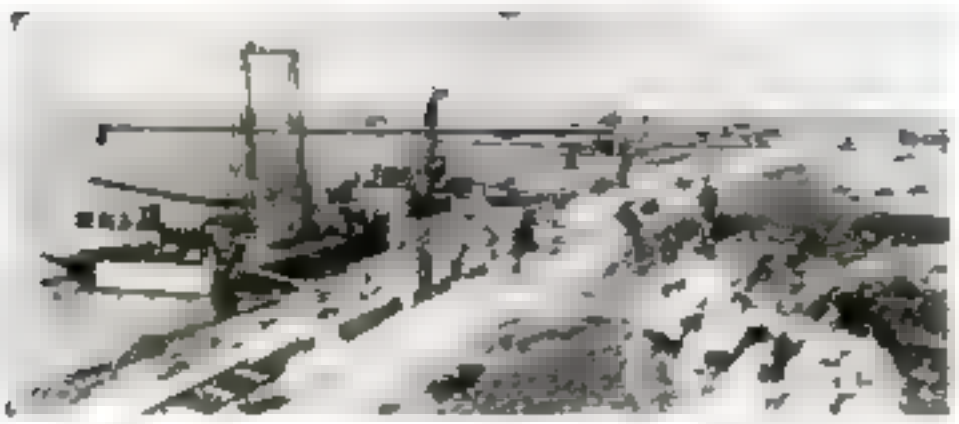
"In combating a modern fire, what single element do you dread most?" The question was asked of Kenlon by a prominent architect at a recent convention of New England fire chiefs.

The grizzled chief hesitated not a moment. "The buckling and collapse of supporting columns," he replied. "They are responsible for the loss of more firemen, and for more disastrous confusion, than any other single element in my experience. And the sad part of it is," he continued, "that with our present knowledge of fireproofing these columns, the tragedy of a total collapse need never occur.

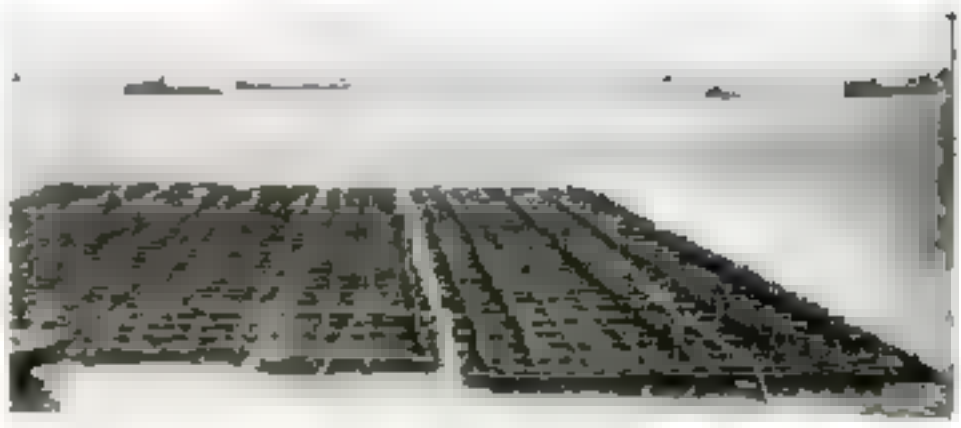
Largely through Kenlon's efforts, modern fire-fighting has become a scientific profession. Above, firemen are learning from an assistant chief how to attack a blaze in a tall building, represented by a model

"FOR a horrible example, take the three-alarm Butler Brothers fire of December 29, 1927. The building which this fire destroyed was an eight-story commercial structure at 495 Broadway. Responding to a midnight alarm, we found a small but very hot fire consuming some crates and excelsior in the basement shipping room. Evidently it had been burning for some time, for the fire had entered the elevator shaft, which acted like a flue, causing tremendous

(Continued on page 169)



Paving the sloping sides of the great earth dike with stone blocks for protection from the sea. Electric cranes unload the stones from barges.



Like log rafts, these willow mats are floated to the dike, where they are laid on the earth to form supporting beds for the heavy stone paving.

A Garden Salvaged *from the* Sea

How Engineering Magic, Flinging a 28-Mile Dike Across the Shallow Wastes of Zuyder Zee, Is Reclaiming a Thousand Square Miles of Dutch Farm Land

By EDWIN KETCHUM

NEARLY a thousand square miles of land, now under ocean water, will be turned into cultivated fields upon the completion of a twenty-eight-mile-long dike, now being thrust across the mouth of the Zuyder Zee, in Holland. When the great dam is finished in 1934, a railroad and a highway, connecting the east of Holland with the west, will run along its top. Behind the dike ten feet below sea level, farmers will till the rich loam of this greatest of sunken gardens.

For seven hundred years—since a break in the dikes in the thirteenth century—the shallow "Southern Sea" has cut into Central Holland with a wide waste of unnavigable water. It is expected that the land now being reclaimed will support from 300,000 to 500,000 people. It will add one tenth to the arable land of the nation.

In all, 2,027 square miles lie under ten to nineteen feet of salt water in this arm of the sea. Some of the land, unfit for agriculture, will be used to form an artificial lake to hold water brought down behind the dike by the Yssel River. Two huge locks and a system of thirty sluices in the dike will allow the water in this artificial lake to escape into the North Sea. When the wind blows from the northwest into the mouth of the Zuyder Zee, it probably will be impossible to discharge water through the sluices, but the extent of the artificial lake, it is believed, will permit storage of the water brought down by the river for several days until the wind changes.

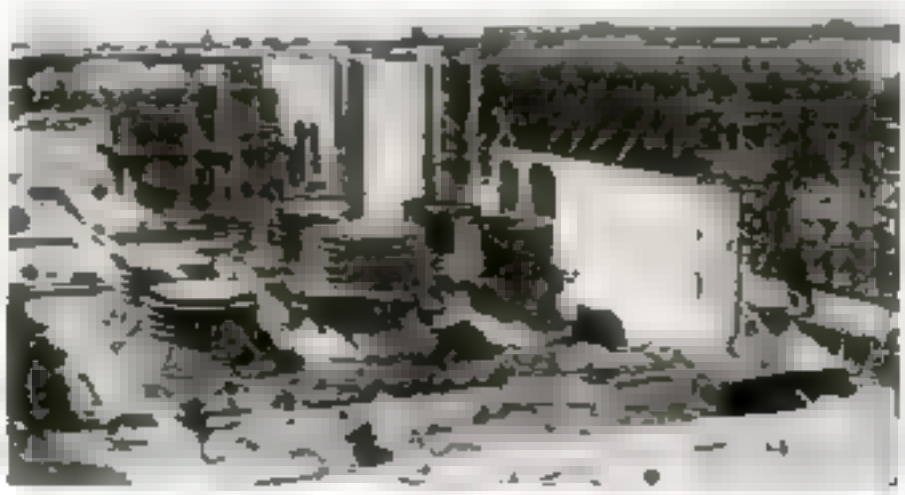
The material which will form the great sea wall, 300 feet thick at its base and rising twenty-three feet above sea level, is mostly earth brought from the bottom of the North Sea by a line of suction dredges. However, the northern part of the dike, most exposed to the waves, will be constructed of a kind of boulder clay found in the Zuyder Zee itself. It has shown that it is proof against the strongest ocean currents.

Black portions behind the enclosing dam indicate land to be reclaimed, covering nearly a thousand square miles and bordering an artificial lake formed by the Yssel River.

An interesting phase of the construction is the use of willow mats. They are placed under a top layer of stone blocks which pave the sloping sides of the dike as protection against the erosion of the sea. They keep the blocks from sinking into the soft earth. By the time they have rotted, the earth will have settled firmly into position. The mats are made on the mainland and towed in strings to the spot where they are needed.

THE total cost of the dike will be about $185,000,000. It is in two sections. The first, from the eastern mainland to the small island of Wieringen, a distance of a mile and a half, has been completed. The longer dike, pushing across nearly twenty miles of open water, from the opposite end of Wieringen to the western mainland, will be finished in about six years. This longer dike cuts across the shallowest part of the Zuyder Zee, where no part—except for two channels between Wieringen and the mainland, where the wall is already built—is deeper than twelve feet.

The originator of the project is Dr. C. Lely, Minister of Public Works in 1918, when the scheme was approved. He had conceived of the plan twenty-seven years before.



The Zuyder Zee dike system will include the world's largest steamship locks, shown here under construction. They will be 2,275 feet long.

Useful Kinks for the Radio Fan

Choosing the Best Antenna

Tests Reveal Trick Aerial Devices Are Not Worth the Price — Mending a Loudspeaker — A Homemade Tube Shield

CONSIDERABLE confusion exists as to the relative effectiveness of various types of outdoor antennas. You probably have read the statement that a hundred-foot outdoor antenna is about right. That is correct only when reception conditions are such as to require that length. While a hundred-foot antenna is a good average, there are thousands of cases when a different length would give better results.

You may be located in the heart of a great city with several powerful broadcasting stations within a few miles of your home. Under such conditions, the standard hundred-foot antenna would have a tendency to cause broad tuning.

Another radio listener may be in a small town hundreds of miles from the nearest station, or in a location particularly poor for reception. Often an antenna 150 or even 200 feet long will give much better results in such circumstances.

Don't be satisfied till you have tried various lengths to find the correct one for your particular conditions.

Remember, also, that the effectiveness of an antenna depends largely on its height, and on the distance between its ends measured in a straight line. Coiling the wire into a small spiral, helix, or other fancy formation immediately cuts its efficiency to that of a single wire no longer than the formation.

One hundred feet of wire coiled into a springlike form fifteen feet long would, for example, be no better than a single wire fifteen feet long.

ANOTHER radio delusion is that you can take a shiny copper ball or the remains of an antique wash boiler, mount it on a pole six feet high, and immediately bring in stations from all over the country. There is nothing to this idea. Such a metal piece is no more effective than a plain piece of wire sticking up in the air to the same height. Tests of various types of these so-called antennas in the radio laboratory of the Popular Science Institute of Standards show them to be a waste of money.

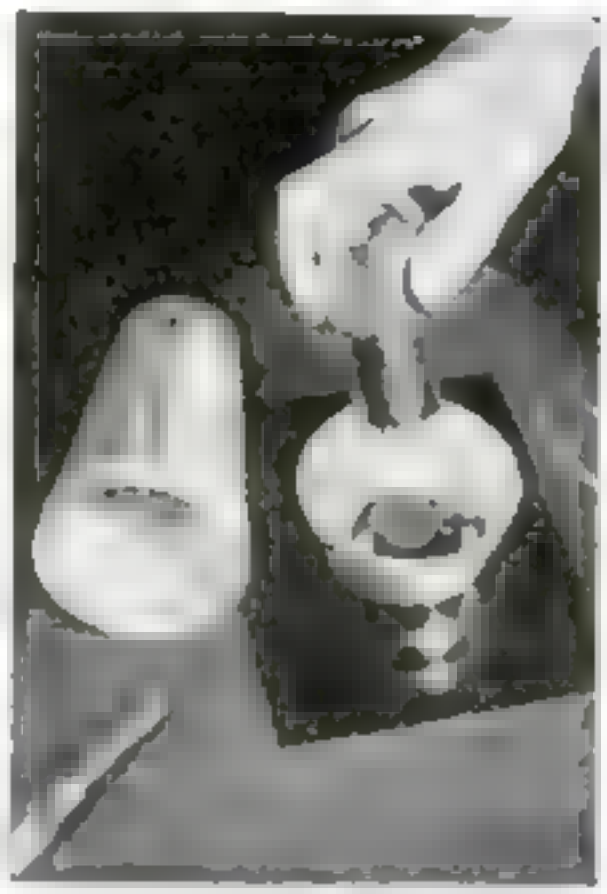


Fig. 1. The small sized milk shaker is converted into an effective metal tube shield.

A Novel Tube Shield

THE radio fan who likes to build things for himself will find that the small size of milk shaker sold in many stores can be made into an effective tube shield. The fitting of such a shield is shown in Fig. 1. The cover is fastened under the tube socket. Be careful that the socket terminals are not short-circuited. You can, of course, drill holes through the cover of the shaker for the wires to the socket terminals, and also a hole on the shaker itself for a grid connection if the tube is of the shielded grid type.

Fig. 2. Using a phonograph to rewind a burned-out loudspeaker coil.

Repairing Your Loudspeaker

THE most common trouble with a loudspeaker is a burned-out coil. This happens to be a defect which can be remedied without difficulty by anyone who likes to tinker and enjoys constructing radio apparatus. Figure 2 shows a simple way to rewind such a coil at home. An empty thread spool is jammed onto the stud in the center of the phonograph turntable, and the loudspeaker coil form is glued or otherwise clamped to it after the old wire has been stripped off.

Obtain an old Ford spark coil or any other make that can be broken open readily. Open it and locate the end of the fine wire wound in layers outside the heavy primary winding. This secondary wire may not be of exactly the same size as that in the loudspeaker coil, but it will be near enough to it so that the coil will function.

Set the phonograph speed regulator so that the record table will turn as fast as possible, and let it wind the wire for you. The fine wire easily breaks, so you will have to be extremely careful. The chief difficulty on this job will be in getting the wire to unwind from the spark coil without catching and breaking. You probably will find that the spark coil will have to be mounted on an easily running bearing so that it will turn easily.

IF THE trouble with the loudspeaker is merely a falling off in volume without signs of chattering or distortion, the magnet may have lost most of its magnetism. Remagnetizing is difficult unless you have special apparatus. The nearest auto service station that specializes in repairing automobile magnetos will be able to do the job, if you can dismount the apparatus and take the magnet to the service station.

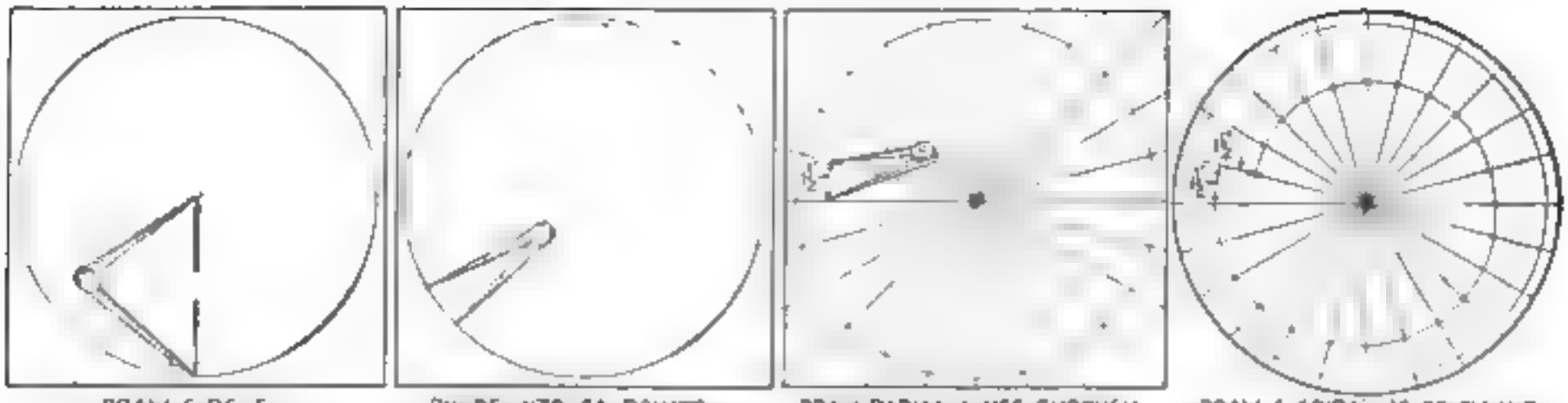
A common trouble is steel shavings between the pole pieces and the armature. Passing a piece of paper between, and at the same time blowing air past the pole pieces eventually will get rid of them. Sometimes they can be removed with the end of a needle that has been strongly magnetized.

A B C's of Radio

THE use of resistances to secure voltages for radio and audio amplifier tubes in electric sets may seem mysterious. Actually, though, the principles involved are fairly simple.

All voltage is relative. A wire may register six volts positive with respect to one wire and be negative with respect to another. The grid element in the amplifier tube must be negative with respect to the filament wire, and the plate of the tube positive with respect to the other tube elements.

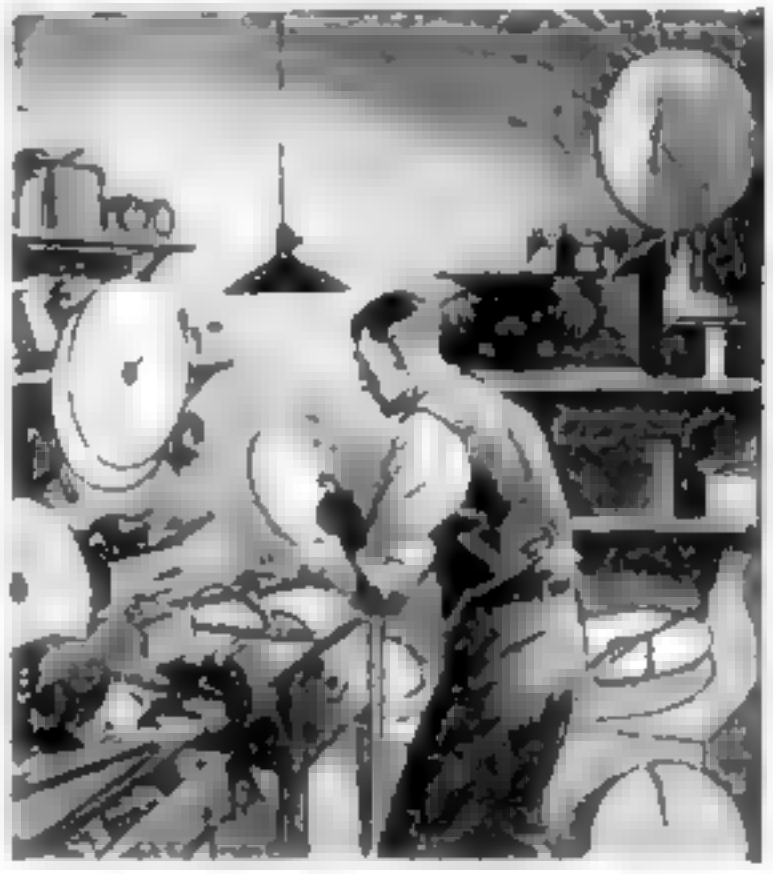
When current is forced through a resistance a voltage can be measured across its terminals. In the amplifier tube-circuit the plate return current is forced through a resistance. The voltage developed across the resistance is applied to the grid.



Making a Television Disk

If You Are Looking for New Thrills, This Article Will Help You to Start Delving into Radio's Latest Marvel

By JOHN CARR



Television, newest scientific infant, offers untold possibilities to the amateur wireless experimenter in his home workshop.

A SOLEMN faced young man in his teens gazed gravely at a shiny red motorcycle. The time had come for a momentous decision. Should the fascinating speed machine be sacrificed on the altar of science? Were the experiments he was making in the budding science of wireless worth the sacrifice? Science won. The motorcycle was sold and the money went into more apparatus.

This all happened in 1910, and the young man who made the decision was Edwin H. Armstrong, who years later won fame and fortune with his invention of the regenerative circuit and the superheterodyne.

Countless other young men who got into radio in its infancy have won high places in various branches of the vast industry.

Television, the newest scientific infant, may be equally good to those who begin delving in its unsolved problems today.

In the September issue of POPULAR SCIENCE MONTHLY, the problems confronting the television experimenter were outlined. This article will show you exactly how to make the television scanning disk. A succeeding article will show you how to assemble the rest of the apparatus and receive "visions," as they are being called.

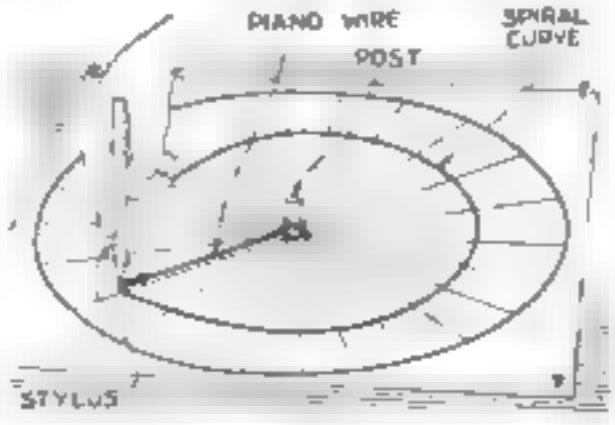
The television scanning disk is simply a circular sheet of thin metal with a spiral of small holes drilled in it. This disk rotates in front of a neon lamp.

The holes in the spiral are so spaced that for each revolution of the disk the holes in succession sweep across every portion of the picture area represented by the plate of the neon tube. First the hole farthest from the center of the disk sweeps across the top edge of the picture. As this hole passes beyond the edge of the area, the second hole starts to sweep a path just inside the path of the first hole, and so on.

The number of holes in the receiving disk must be the same as in the transmitting scanning disk at the broadcasting station.

At present experimental television transmission is being carried on with disks having twenty-four, thirty-six, or forty-eight holes.

The size of the scanning disk is determined by the size of the plate in the neon tube and the number of holes in the spiral. With a neon tube having a plate one and a half inches square, the



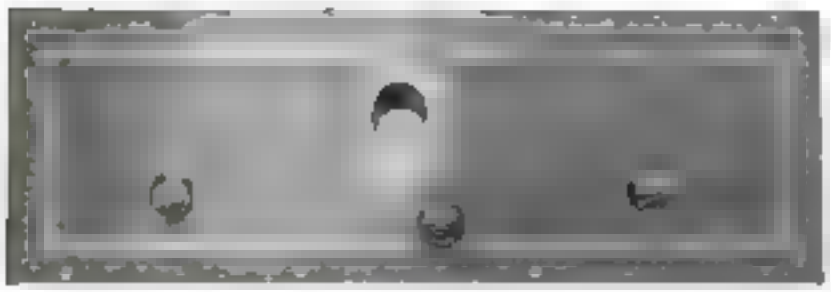
How to scribe the spiral for the holes, using piano wire and stylus. Detailed instructions and measurements are given in the article.

maximum picture it will illuminate will be one and a half inches wide and one and a half inches high. Because the forty-eight-hole spiral necessarily must be larger than the thirty-six-hole spiral and the latter must in turn, be larger than the twenty-four-hole spiral, it is possible to make one large disk with all three spirals in it. Then, by mounting the neon tube so that it can be moved in line with any one of the spirals, you will be prepared to receive from any station using a spiral with that same number of holes—provided, of course that your motor drive can be varied in speed sufficiently to synchronize with the speeds at which these various spirals are driven.

The method of laying out the spiral is quite simple, but it is well to experiment with a large sheet of paper first.

FIRST draw a circle of any convenient size. Then step off on the circumference the number of holes there are to be in the spiral. You can do this without the use of a protractor merely by trying different compass openings until you find one that comes out just right. If, for instance, the first time you step the compass around the circle, you find that you pass the starting point before you reach the required number, close the compass a bit and try again.

After you have the points on the circumference located draw from the center of the circle through these points. Then, with a ruler, set (Continued on page 140)



Front view of the two-tube receiver with added knob

Adding an R. F. Stage to Our New Set

By This Easy Step, You Can Develop the Receiver Described Last Month to an Up-to-Date Two-Tube Outfit

By ALFRED P. LANE

IN THE November number of POPULAR SCIENCE MONTHLY there appeared a detailed description of the construction of a simple one-tube radio receiver designed particularly for beginners. Several novel features were embodied in the set. It tuned the short waves as well as the broadcast band, and additions could be made to it later on.

The logical procedure in making these additions to the one-tube circuit is first to add a stage of radio-frequency amplification, and after that add the necessary audio amplifier stages for loudspeaker volume. There are several reasons for this. First, the radio-frequency stage can be operated on the 45-volt B-battery you already have purchased for the detector stage. The need for a B-eliminator therefore is postponed until required to fully electrify the set after the audio stages have been added. Second, if you encounter any trouble at all, it is more likely to be in the radio-frequency amplifier stage than in the audio amplifier stages, and it is easier to find the trouble and correct it when there are only two tubes.

The receiver described here is the one-tube set shown last month plus a stage of radio-frequency amplification. It is, therefore, a complete two-tube set suitable for headphone reception. It is much more selective than the one-tube outfit and will give better results on distant stations.

Plug-in coils are used so that you can tune the short waves as well as the regular broadcasting. The stage of radio-frequency amplification works nicely through the broadcast range, but you will find that it cannot be used on the short waves. Any ordinary form of radio-frequency amplification is almost useless on the short waves. Consequently, it is not absolutely necessary to use a plug in coil to tune the radio-frequency stage. A simple home-wound coil can be used. In fact if you are not interested in the reception of short waves, plain home-wound coils can be used to tune both the radio-frequency and detector stages at a considerable saving in the cost of materials.

Details of the necessary coils for variable condensers of various capacities are given on POPULAR SCIENCE MONTHLY Blueprint No. 98, which shows the construction of this two-tube set.

A feature of this receiver that will appeal particularly to beginners and students is the ease with which the receiver may be adjusted for best results in any given locality. By moving the coils *A1* and *A2* farther away from coils *B1* and *B2*, the selectivity can be increased, and if the user is located a long distance from a broadcasting station so that selectivity is not so important, the sensitiveness of the receiver can be increased to a marked extent by using coil *C2* in place of Coil *A2* as the antenna coil.

IF YOU have built the one-tube receiver, the cost of making it conform to the arrangement in this article will be limited to the price of the additional parts and one tube of the 226 type. This is the A. C. tube that operates on 1½ volts A. C.

For your convenience, we list the parts needed to build the two-tube receiver in two sections. The first section covers the parts already in the one-tube outfit and the second lists the additional parts you will need to add the stage of radio-frequency amplification.

These parts you have:

A1, B1, C1—short-wave coil set, including extra coils to cover the broadcast band of wave lengths.

D1—variable condenser, .00014 mfd. capacity.

D2—grid condenser, .0001 mfd. capacity with clips.

D3—fixed condenser, .0005 mfd. capacity.

E1—radio-frequency choke coil, 85 millihenries inductance.

F1—grid leak, 5 megohms.

F2—variable resistance, 0 to 5,000,000 ohms.

G1—socket for heater type 227 vacuum tube.

These parts you need

A2, B2, C2—mounting and broadcast band coils (or home-wound coil).

D4—variable condenser, .00014 mfd. capacity.

D5—midget variable condenser.

D6—bypass condenser, ½ mfd. capacity.

F3—6-ohm potentiometer.

F4—2,000-ohm fixed resistance.

G2—standard X-type vacuum tube socket.

H—oscillation controller.

One ¼-inch shaft coupling.

If you prefer to make the tuning unit instead of using the plug-in coils and the special mounting, wind a plain coil

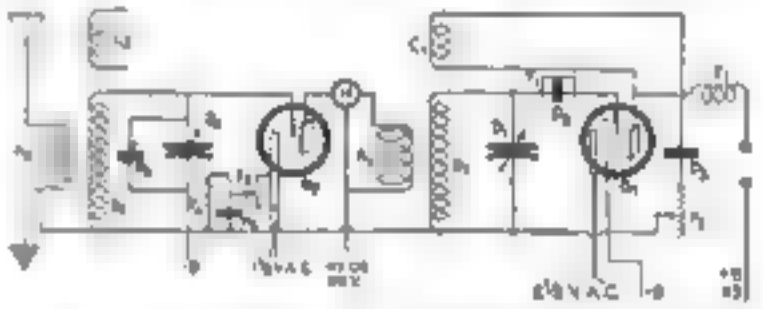


Fig. 2. Technical wiring diagram. Note that *A1* which was the antenna coil of the one tube set now becomes the plate coil for the added radio-frequency amplifier tube.

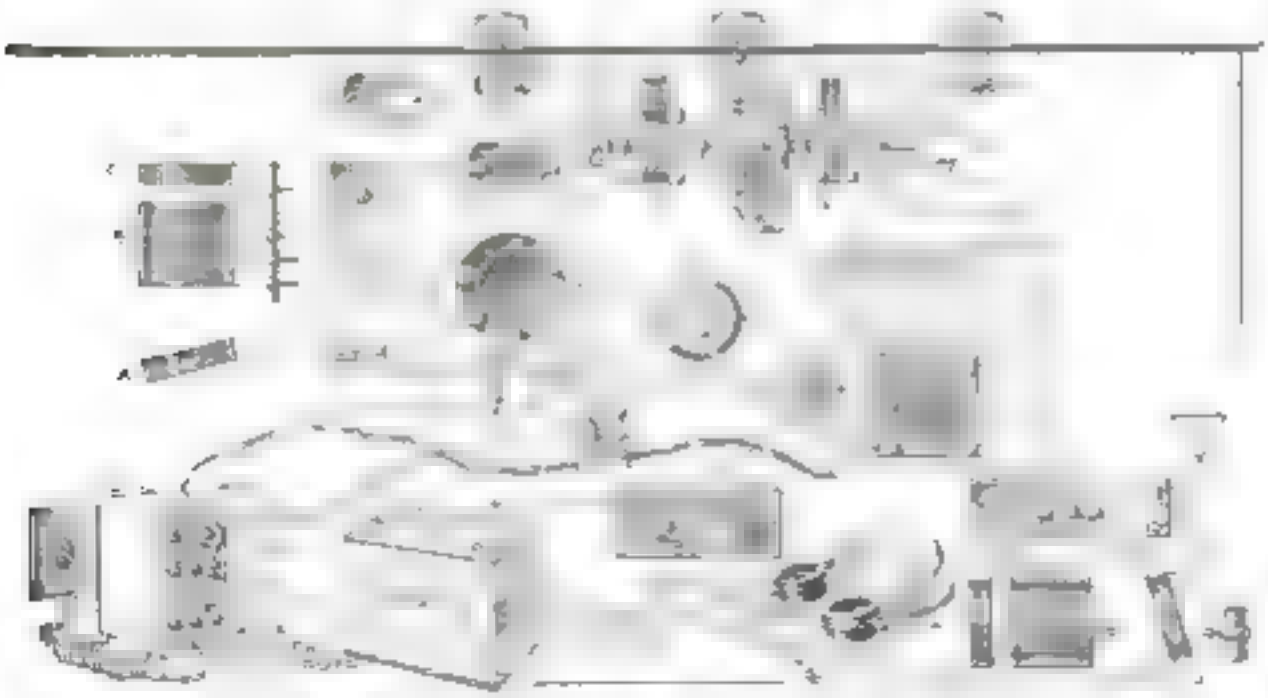
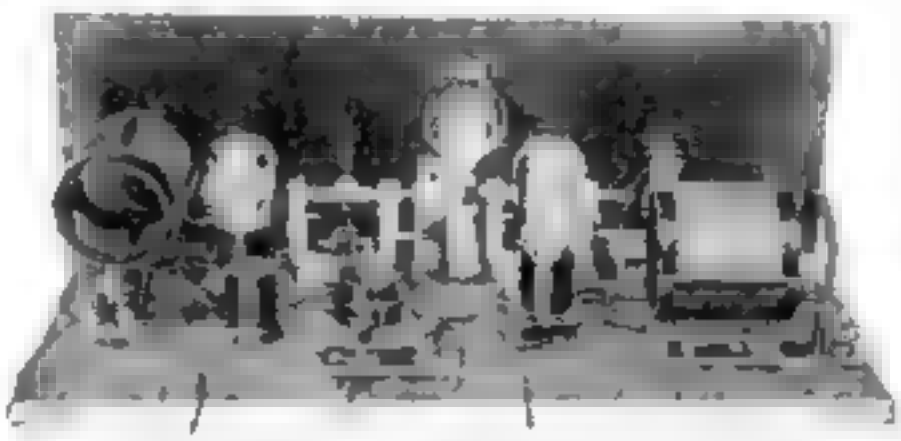


Fig. 1. This pictorial diagram will make it easy for beginners to follow the layout of parts and wiring of the two-tube set. It also shows the battery, power transformer, and phone connections.

on three-inch cardboard or composition tubing, consisting of 92 turns of No. 24 wire for *B2* and ten turns of wire right next to it for *A1*. This coil and the similar plug-in coil at *A1*, *B1*, *C1*, tune the waves from 550 down to about 235, so that if you do not want to bother with the smaller stations on the waves between 235 and 200 only one coil *A2*, *B2* will be needed.

If you are not interested in short-wave reception and wish the set only for bringing in broadcasting on the regular bands, you can eliminate the plug-in coils entirely and wind at home two fixed tuning units. If you do that it would be advisable to use larger variable condensers at *D1* and *D4*. Using three-inch coil forms at both points, here are the winding specifications of suitable tuning units for the two most popular sizes of variable condensers: Using .00035 condensers at *D1* and *D4*, wind *A1* and *A2* with ten turns, *B1* and *B2* 60 turns, and *C1* with 80 turns. For .0005 condensers, wind *B1* and *B2* with 50 turns, other coils the same. Use No. 24 wire.



Rear view of the two-tube receiver with tubes in place. Make sure that the tuning unit at the right is placed as shown, with grid end to the left

THE midget variable condenser *D3* is necessary because of the effect produced by antennas of different lengths.

The oscillation controller is a small bakelite case containing a small fixed condenser and an adjustable resistance. While it does not give quite as sensitive results as the usual balancing condenser, it has the merit of being easy to adjust and it is foolproof, points which will be appreciated by the beginner.

The first step in adding the stage of radio-frequency amplification is to mount the variable condenser *D3*. The shaft of *D3* can be pulled through the drum dial far enough to connect the shaft coupling to it, or if you can procure a perfectly straight piece of quarter-inch brass rod you can cut a piece long enough to reach from one variable condenser through the drum dial and the rotor of the other variable condenser.

ANOTHER hole will have to be drilled in the panel for the midget condenser *D3*. This condenser is necessary, otherwise the radio-frequency and detector stages will not tune exactly alike owing to the effect of the antenna coil.

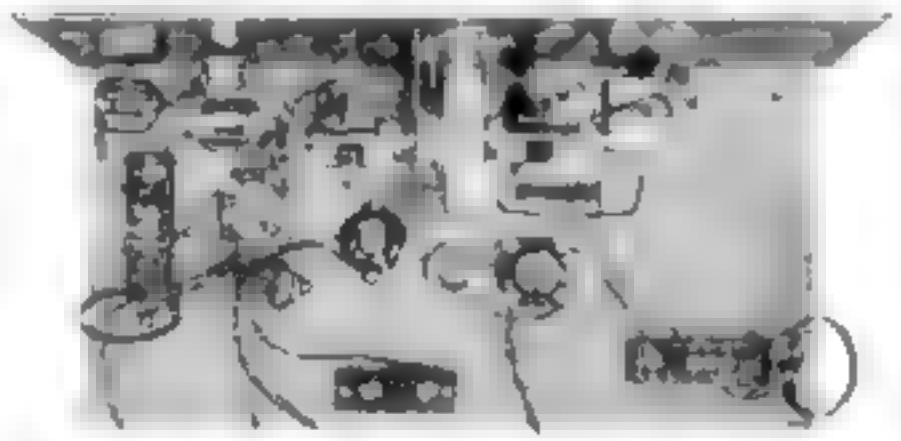
The other parts can be mounted on the baseboard as shown in the photographs and in the pictorial diagram. Absolute accuracy in the placement of the parts is not needed. Tuning unit *A2*, *B2* must, however, be parallel to the back edge of the baseboard with the grid end of *B2* pointing toward the detector end of the set.

As you will note from a study of the wiring diagrams in Figs. 1 and 2, the circuit of this set is just like the one-tube set described last month, insofar as the detector wiring is concerned, except that *A1*, which was the antenna coil, now becomes the plate coil for the radio-frequency amplifier tube. Follow these diagrams and you will have no difficulty with the wiring. Note that the rotary plates (the frame) of condenser *D4* are connected to the rotary plates of condensers *D1* and *D3*, as well as to the F terminal of coil mounting *A2*, *B2* and to one end of fixed resistance *F4*. If you use the plug-in coil at *A2*, *B2* and you are some distance from the broadcasting stations, use *C2* as the antenna coil instead of *A2* or if you wind your own coil, increase the number of turns in the antenna coil.

After you have made all the connections as shown in the wiring diagram, proceed to make the additional connections to the A-power transformer. This means connecting the 1¼-volt twisted leads from socket *G2* to the 1¼-volt binding posts on the transformer, and also running a wire from the center tap of the 2½-volt winding to the ground terminal.

Note that the wire that supplies B-current to one terminal of coil *A1* and which the diagram of Fig. 1 shows connected to the 45-volt terminal of the B-battery may be connected to the 45-volt terminal of an additional B-battery connected in series with the first one, if you desire to apply ninety volts to the plate of the radio-frequency tube. This will slightly increase the radio-frequency amplification.

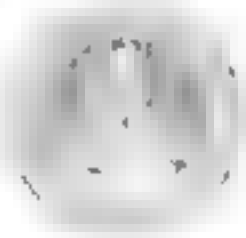
Be sure to check all connections at least twice. Then you may put the 227 tube back in socket *G1* and put a type 226 tube in socket *G2*. Now plug the filament heating transformer into the wall socket and after the usual wait for the 227 tube to attain operating temperature you are ready to tune a station. Screw in knob on *F2* until the set is in oscillation, and then turn the condenser tuning knob until you hear a whistle that marks a station. Screw out the knob on *F2* until the squeal stops and then loosen the set screws that hold the rotor of condenser *D4* to the shaft after setting the knob of condenser *D5* so that the plates are one quarter engaged. Now, with your finger on the rotor of condenser *D4* and your other hand grasping the condenser tuning knob on the panel, move the rotor of the condenser and the tuning knob until the station is as loud as possible. Then tighten the set screws. If you wish to tune the same station again, merely turn the dial to the same number and adjust the knobs on *F2* and *D5* until the signal is as loud as possible.



View of set from above, showing relative positions of coil mountings, condensers, tube sockets, and so on. Follow this layout by eye measure.

POPULAR SCIENCE MONTHLY Blueprint No. 98, describing in still greater detail the construction of this modern two-tube receiver, may be obtained for twenty-five cents (see page 102).

A complete list of parts approved by the Popular Science Institute of Standards for use in constructing the receiver will be mailed with each blueprint or sent free to readers who wish to work from this article. Address requests for advice or information to: Radio Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City.



IF YOU find that you cannot get rid of the whistle even when the knob of *F2* is all the way out adjust the oscillation controller with a screw driver. There is a slot in the shaft that projects through the top of the instrument for the purpose.

These instructions apply only on the broadcast band of wave lengths, that is, if you use the plug-in coils for the coil with the largest number of turns that tunes from 235 to 550 meters and for part of the coil that tunes from 125 to 250. Below that point you cannot use the radio-frequency stage, so when you wish to tune the short waves, pull the tube out of socket *G2* and move the antenna wire from the binding post that is wired to one end of coil *A2* over to the binding post on coil *A1* that is connected to the F terminal of socket *G2* by way of the oscillation controller *H*. Then the plug-in coil for the wave band you desire is placed in the mounting at *A1*, *B1* and the receiver is used in its single-tube form. To facilitate changing the antenna wire, you can fit it with a battery clip. It is not necessary to change the ground wire, since the necessary ground is obtained through the wiring of the receiver.

While it would be a simple matter to fit a switch to the panel to shift the antenna, it would not be of any particular value, as you have to shift the plug-in coils anyway, and while you have the top of the cabinet up for this purpose you can change the antenna wire. Most of the time the receiver will be in use for broadcast reception on the waves above 235 meters.

HAVE you built a POPULAR SCIENCE MONTHLY radio receiver? Thousands of them, constructed in all parts of the country, are giving extraordinary satisfaction. Every new radio set presented to our readers first must have passed the rigid tests of the Popular Science Institute of Standards. Yet all are so simplified that a beginner can readily follow the construction details.

New *Novelty* Finishes

How to Decorate Art Wares in Brilliant Modern Modes at a Fraction of Store Prices

By BERTON ELLIOT

Candlestick with marbled finish obtained by drawing it through a film of floating colors.

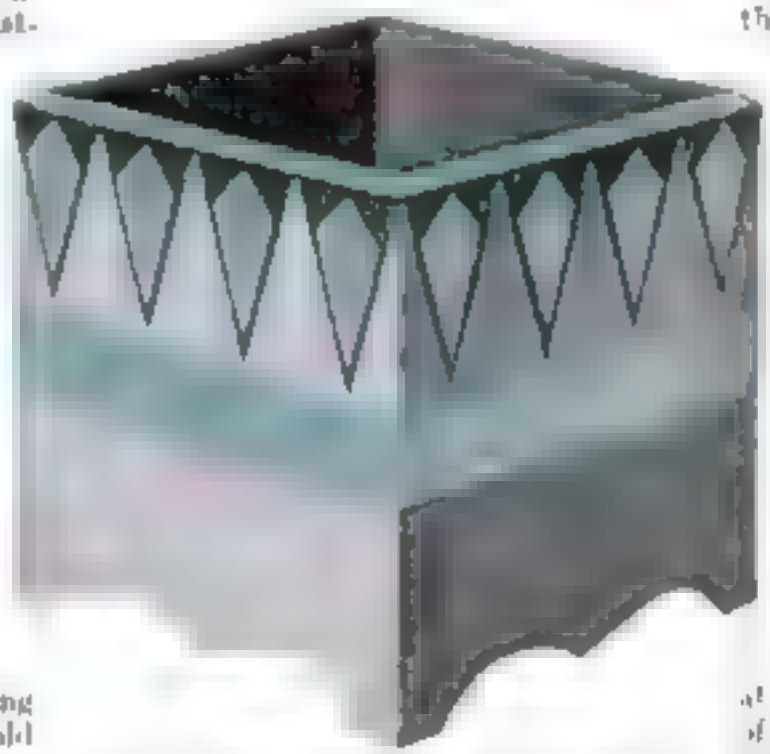
THE vogue for home painting and decorating offers many opportunities for making smart Christmas gifts at a cost far less than their actual worth and market value. Because of their individuality, such gifts are far more appreciated than ones that are bought. Boxes, book racks, book ends, and novelties finished in the modernistic fashion and in colorings to correspond with the decoration and furnishings in the home of the recipient, are gifts of real personality.

New treatments and fashions are being constantly brought into popularity. At this time the trend is toward the modernistic angles, triangles, rectangles, and geometrical forms. The use of pure color in the decoration of furniture, accessories, and art wares is a prevailing characteristic, as is the use of rich gold and silver for edgings.

After objects have been finished in the usual manner with enamel, lacquer, or other painting materials, we can decorate them in any of the following ways.

First, with art transfer patterns (decalcomanias). Modernistic designs have been developed by transfer manufacturers, and many decorative requirements, therefore, can be met from patterns available at most up-to-date paint stores. The method of applying transfers is now well known and was covered in detail in the July, 1927, issue of POPULAR SCIENCE MONTHLY. Usually the manufacturer supplies brief instructions with the transfers.

Stencils are also obtainable in nearly every locality. Since the advent of



Modernistic design applied to a potted plant holder by the new and very simple method of using masking tape, as illustrated in the photographs below.

sprayers, stenciling has been used extensively for the decoration of furniture novelties and accessories. The stencils should be held very tightly against the surface to guard against blurred or ragged edges.

Pins or tacks cannot be put into fine art wares and furniture, but a stencil usually can be held down with weights around the edges, or holes can be made in the stencil at intervals around the edges and gummed paper or pieces of tape pared over the holes and pressed through onto the surface being decorated. Ordinarily this will not leave any mark on the surface, but in case it does, the remaining adhesive can be readily removed with a cloth moistened with water or a mild mixture of half gasoline and half water.

When stenciling is done with a sprayer, any type of material may be used—enamel, lacquer, or paint. The surface surrounding the stencil design must, of course, be protected from the spray. Cut a hole a little larger than the design part of the stencil in wrapping paper or newspaper and place the mask on the surface you are decorating. Then fasten the stencil in position over the hole, letting its edges overlap the mask.

When stenciling is done by pouncing with a brush, lacquer has a tendency to pick up the undercoatings; if carefully done, however, it can be put on through the stencil openings with a soft camel's-hair brush.

Oil colors reduced with turpentine are ideal for stenciling but, of course, give a flat finish. The design can be brightened up, however, with a coat of clear varnish or lacquer applied with a small brush over the design part only, or as a protective coating over the entire surface.

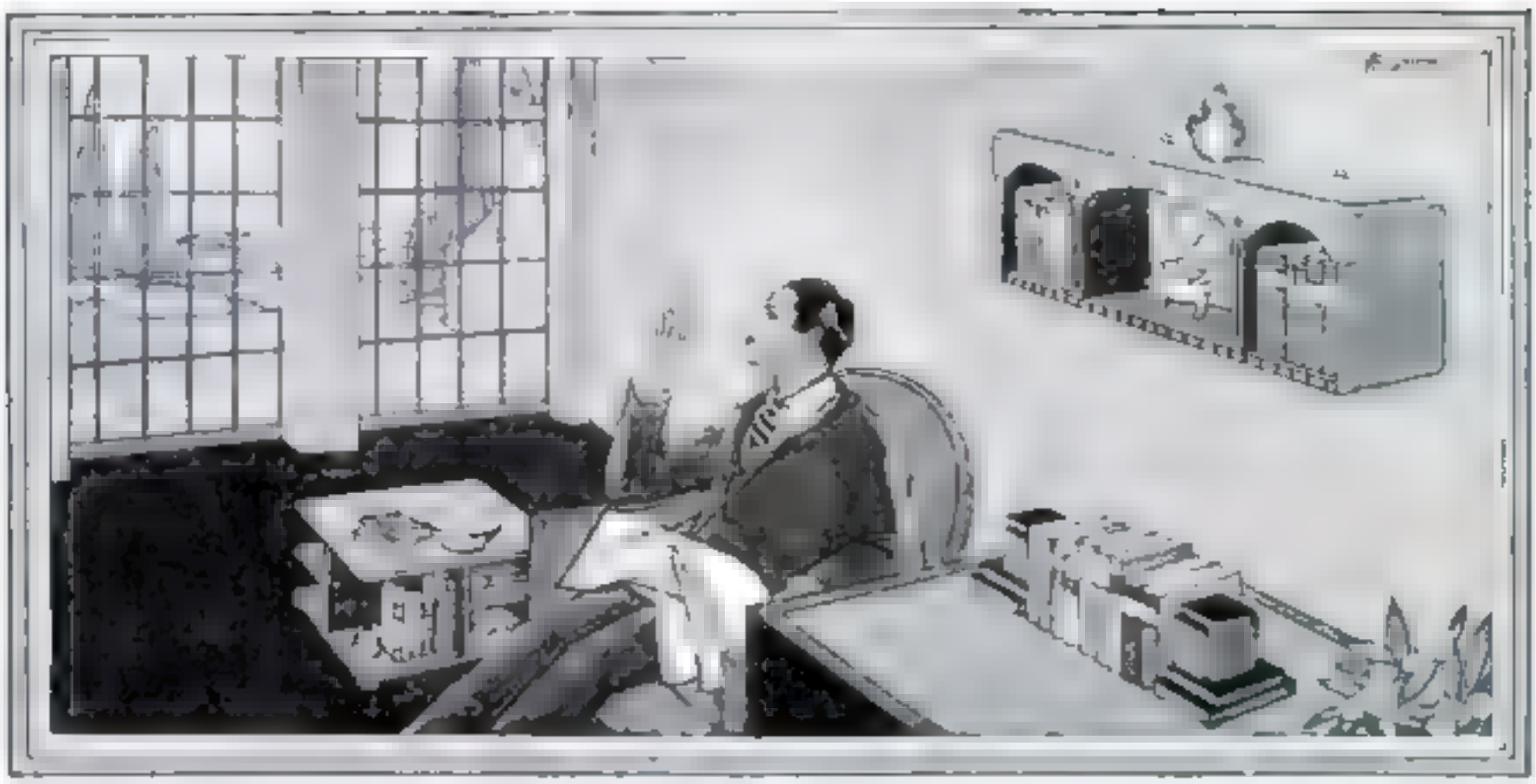
Another method of obtaining modernistic designs, and one which permits more individual treatment, is to take a suitable design in the new dress goods or draperies or from a magazine illustration, trace it on a sheet of oiled paper, and cut a stencil with a sharp knife or razor blade, leaving the necessary "ties" at frequent intervals to prevent portions of the design from dropping out.

Those with a talent for free-hand drawing can make original designs for stencils or paint directly on the piece being decorated. In

(Continued on page 30)

Gummed tape is used to make masks for shielding certain parts of the design before painting.

After it has protected one part while another is being painted, the masking tape is peeled off.



Nothing more modern than these pieces can be found in the most exclusive stores.

Smart Gifts Any Man Can Make

Novel Skyscraper Book Ends of Utmost Simplicity— A Modernistic Bookshelf and a Low Cubby-Hole Stand

By HERMAN HJORTH

NO MATTER what style furniture you have in your home, you can safely introduce a few accessories or small pieces in the popular modernistic mode. It is true that they are costly to buy, like everything else that is considered smart and fashionable, but you do not need to go to the stores for them; you can make them yourself.

Even when your furnishings are in strictly period style, some of the smaller accessories can well be modern. They will add the touch of originality and color that is greatly to be desired, they will provide the accents—bright spots of interest.

Look at the book ends illustrated. What does their vigorous set-back shape remind you of? More than anything else, a modern skyscraper, so bold and rectangular. In their sharp and vivid way, they give you the modernistic mode in miniature. Yet you can make them at trifling cost and with little expenditure of time and trouble. Let them pit their bulk and weight against half a dozen brilliantly bound volumes on your book table, or, if you think some friend could make better use of them, box them up and set them aside until Christmas. They will be a more up-to-date and, being handmade, a more welcome present than you could hope to find in any gift store.

Two other modern pieces are shown. One is a hanging bookshelf with a mirror at the back of one of its three compartments, in this compartment a bit of colorful pottery or somesother ornament can be placed, while the books go in the two end divisions. The third piece is a characteristic low stand with cubby-holes for this, that, and the other.

TALK turns to the modernistic style wherever furniture men meet. This is fortunate for the man who likes to build furniture because the new styles are so simple. That is why POPULAR SCIENCE MONTHLY so promptly prepared the present series of articles on modernistic furniture. Four blueprints are now ready—Nos. 88, 91, 93, and 100 (see the list on page 102).

All three pieces are of types which proved to be popular at modernistic exhibitions in New York this year, but they are not copies of commercial designs. They were developed especially for the readers of POPULAR SCIENCE MONTHLY by the writer with the assistance of William H. Varnum, Associate Professor of Applied Arts at the University of Wisconsin, who is a recognized authority on industrial design.

To aid those who wish larger working drawings than can be given in the magazine, a blueprint has been prepared with scale drawings of the three pieces, together with lists of materials, tools, and operations. The blueprint, which is No. 100 in the list on page 102, will be sent to any reader for twenty-five cents.

It is the bold grouping of the primary mass of the book ends that makes them reminiscent of modern buildings. The black edges and surfaces accentuate this grouping and give the planes a sort of sharp, sunlit relief.

Exceedingly simple of construction, the book ends (see page 117) require little more than the squaring of the blocks and the smoothing of the surfaces. Any light colored but fairly heavy wood like birch or maple is suitable.

Plane pieces of wood of sufficient length to serve for both ends. For example, four sidepieces ⅝ by 8¾ by 3⅛ in. are needed; they should be cut from a piece of lumber squared to ⅝ in. thick, 8¾ in. wide, and about 16 in. long. A miter box will be a great help in cutting the ends square. The pieces should be scraped and sanded perfectly smooth. If the sandpaper is wrapped around a block of wood, the danger of rounding the corners will be minimized.

The shaded edges and surfaces should be lacquered black before the blocks are glued together. First the heavy central block is screwed to the upper base piece; then the sidepieces are glued in place, finally the lower base piece is added. Spread the glue (Continued on page 117)

Banjo Clock Built for $10

All You Have to Make Is the Case—The Works, Brass Ornaments, and Glass Panels Can Be Bought Ready-Made

By
CHARLES A. KING

HOW many home workers have wished to make a banjo clock case but hesitated because of the difficulty in obtaining suitable movements and ornamental brass work? That is no longer an obstacle, for the clock illustrated, although especially designed for readers of POPULAR SCIENCE MONTHLY, will fit one of the standard sets of brasses sold for use by amateur craftsmen.

Such a kit usually includes an eight-day movement, a silvered dial, a bronze-plated sash, a pair of pierced hands, two side brass scrolls, an eagle finial, and two decorative glass panels. The cost is in the neighborhood of seven dollars. To this, of course, must be added the cost of the wood, which is trifling, and finishing materials—not more than ten dollars altogether. Whitewood, birch, gum, or any wood which will take mahogany stain can be used, if genuine mahogany cannot be obtained.

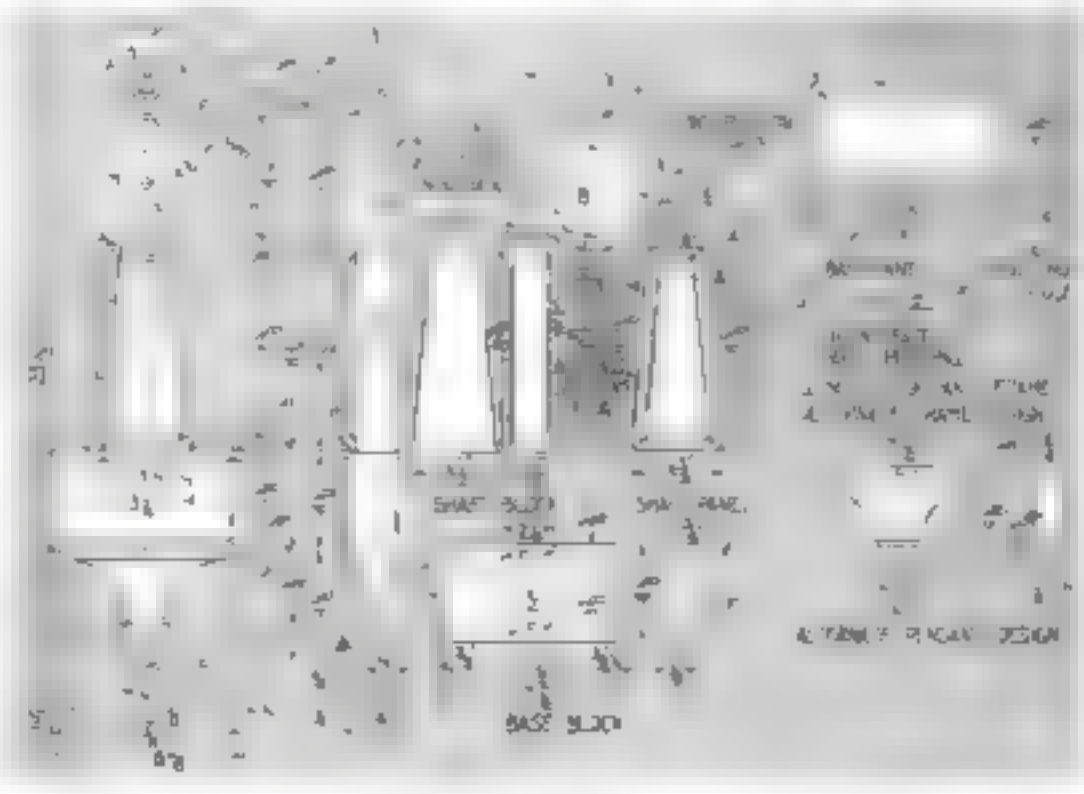
Make the top drum in segments as indicated by lines *1-1* at *B*. Twelve segments ¾ in. thick will be needed, or 18 pieces ½ in. thick, each with the grain running lengthwise. Make a pasteboard pattern and cut the inside curve of each segment accurately, but leave the outside curve with sufficient allowance for working it down to size after the drum has been glued. Lay each segment so the inside coincides with a 4½-in. circle drawn upon a piece of pasteboard. Build up the drum and glue and fasten the segments with brads. Break the joints about as indicated by lines *1-1*, whether the segments are in two or three layers. Be sure the inside is just 4½ in. in diameter and 1¼ in. deep.

FASTEN on the ¼-in. back with glue and brads, and make the outside of the drum 5¾ in. in diameter and as smooth as possible.

Get out the shaft block, 1½ by 3½ by 5¾ in., tapering to 2 in. wide at the top. Prepare the base block, 1½ by 4½ by 7½ in., with two pieces ¾ by 1¾ by 4½ in. glued and braided on the ends as at *C* to cover the end wood.

Plane a flat place at *D* on the drum to rest upon the top of the shaft block.

Most decorative of all timepieces designed to hang on the wall, a banjo clock is also one of the easiest to construct.



Front and side views of the banjo clock case, how the drum is built up in segments; the shaft and base blocks, panels and moldings, simplified base and pendant designs.

Glue and fasten drum and shaft with 1¼-in. No. 8 screws. Plane another flat place 1¼ in. wide on top of drum at *E* to receive the finial base.

Either dowel the base block and shaft together, or bore holes *F* and *F'* through the base block and fasten the shaft with glue and screws.

The molding for the glass panel frames must be rabbeted, but the face may be either flat or round as at *A*, the latter is preferable, but it is more work.

ANOTHER choice exists in making the corners of the frames: they must be mitered, glued, and braded, but may be left plain or covered with a small piece of wood glued on as at *G*. If rounded molding has been used, however, the squares must be set in as at *G'*. Do not fasten the panels to the blocks until after finishing the clock.

Make the finial base and the pendant with the grain running vertically in each. They may be hand sawed if a very fine hand saw is available. Note the simpler alternate designs. Be sure that the forms are true and that the corners are straight. Fasten them in place with glue and brads.

Make a piece ¼ by ¼ by 3½ in. to fit under the shaft panel frame as indicated in the drawing at *H*, and glue in place.

Smooth and sandpaper all exposed surfaces carefully. Stain all pieces and apply three or four light coats of shellac. Rub each coat with No. 4/0 sandpaper. Finish the last coat with wax.

Fill the panel frames with the ready-made glass panels. If these are not used, plain glass may be cut to fit the rabbets of each frame and either left as it is or decorated by hand or by fitting a picture behind the glass.

Fasten the frames to the base and shaft with a few ¾ in. No. 10 brads. Set the brads, fill the holes with colored putty, and touch with wax. Put the brasses in place and install the movement, dial, and sash.

Toy Fire Engine Pumps Water

Sprinkler Cart Sprinkles, Dump Truck Dumps, Tractor Makes Tracks — EDWARD THATCHER *Tells How to Build Them at Trifling Cost*

Fig. 1. The toy tractor is built entirely of wood with nail-studded bull wheels.

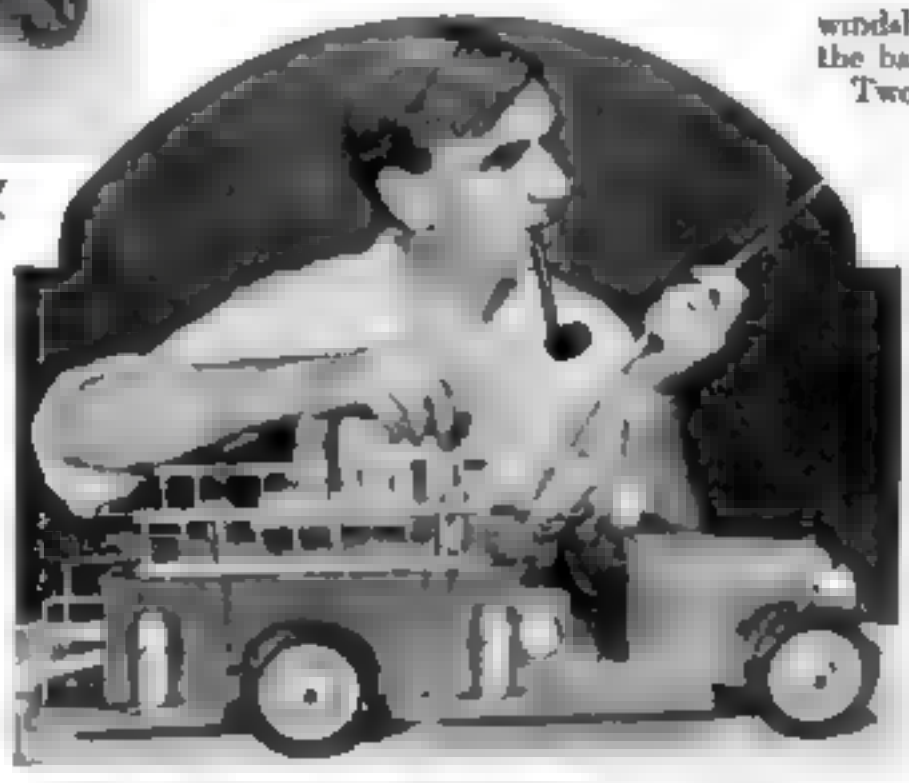


Fig. 3. Mr. Thatcher equally distinguished as a craftsman in metal and a toy designer throws a stream with the fire engine.

NO TOYS are equal to those made by Daddy. And here are some that are quite simple for him to make. They are toy tractors and trucks, strongly built of wood and as large as the expensive ones sold in the stores. They "work" too! The fire engine squirts a good stream of water from the hose; the sprinkling truck sprinkles water just like a big one, the dump truck has a boat that tips up the body, and the tractor, being quite large and heavy, makes a noise like an engine exhaust as it rolls along on the cleats of its bull wheels.

To aid readers in constructing the toy, a blueprint has been prepared with larger drawings and more details than it is possible to show in the magazine. This blueprint is No. 101 in the POPULAR SCIENCE MONTHLY series and can be obtained for 25 cents (see page 102).

Let us begin with the sprinkler shown in Figs. 4, 5, and 6. The chassis is made of a single length of pine or whitewood board ⅞ in. thick, 4½ in. wide, and 17⅝ in. long. This board is cut at an angle underneath at both ends as shown with a chisel and plane. The running boards may be a single piece of ¼- or ⅜-in. stock, 6½ in. wide and 8¾ in. long, glued and screwed or nailed to the bottom of the chassis. All corners of the chassis and running boards should be nicely rounded.

The hood and radiator may be made from a single block of soft pine or whitewood 2⅛ by 3 by 4½ in., or, as in all the models shown, built of several layers of ⅜-in. boards, glued together bread-and-butter fashion, as ship models are made. This block may be sawed with hand saws or band sawed out, then planed to shape, and the ends finished on a disk sander, if you have one, or with a sandpaper block.

The filler cap is a length of ¼-in. dowel set in a hole bored for it. If a hole is to be bored near the end grain of the wood, as in this case, it is better to bore it before the block is cut off at this end, to avoid splitting. The block forming the hood and radiator is nailed and glued flat on the chassis.

The cab is made of pieces of ¼- or ⅜-in. whitewood or pine or laminated wood (plywood). Two pieces of the same size and shape (4⅛ in. wide and 4 in. high) are cut for the front and back of the cab. In the one used as a front, an opening is sawed with the coping saw to represent a windshield. A smaller opening is cut in the back for a rear window.

Two sidepieces are next cut out; they are 2 in. wide at the bottom and 2⅛ at the top, and are 4 in. high. Windows and the front edge of each side are cut as shown.

The seat is a single block, nailed and glued to the floor of the chassis. To it the sides and the back of the cab are nailed and glued. The front of the cab is glued and nailed to the hood block and to the floor. It is a good plan to put the front in position first and then drill a slanting hole to receive the dowel rod used to support the steering wheel.

The steering wheel is a large wooden button mold screwed to the end of the dowel, on which it may be turned. When the wheel is in place, the sides, back, and top of the cab may be put in place. The top, 4 in. long and 4⅜ in. wide, has all its upper edges well rounded over with plane and sandpaper.

Fig. 2. The dump truck has a foolproof dumping mechanism, the principal parts being a dowel, a spool, and a piece of tape.

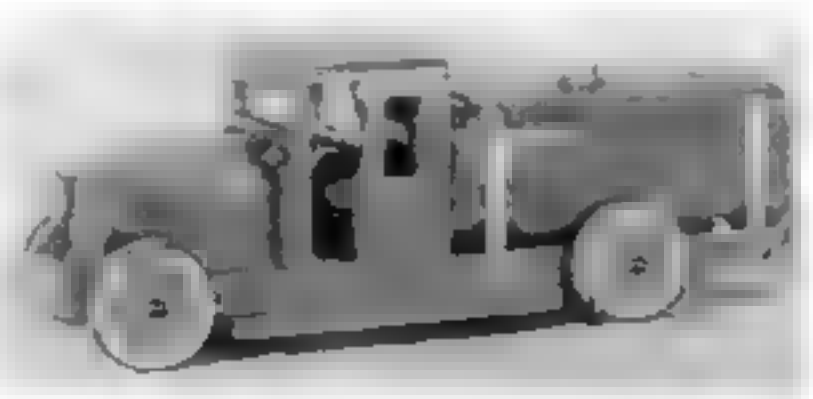


Fig. 4. A discarded tin can serves as the tank of the sprinkler truck, and fruit jar rubbers form the tires on the wooden wheels.

Two dozen fruit jar rubbers will be enough to make tires for the four wheels, five being used for each of the two front wheels and seven for the wider back wheels. As sold now, jar rubbers have a little lip on one side; this may be easily trimmed away with the scissors.

Saw out or turn up four disks of wood, each one being as wide as your tire is to be. These disks should be of the same diameter as the central opening in the jar rubbers. Next saw or turn slightly larger disks of thin wood for the sides which hold the jar rubbers in place. All these disks should have a ⅝-in. hole drilled through the center.

If you have a lathe, you may save much time by roughly (Continued on page 123)

Stenciling Christmas Cards

A Simple New Way to Prepare Your Own Yuletide Greetings

By

F. CLARKE HUGHES

The brilliant and beautiful originals of these Christmas cards were produced by a simple stenciling method. Anyone can make cards of equal charm

HANDMADE Christmas cards carry with them a touch of individuality and attractiveness not to be found in any machine-made cards. You have only to design and make your own cards to be certain they will be prized and preserved by all who receive them.

Of the many different methods used, the linoleum block process has been the most popular one thus far, but unless the cutting and printing are skillfully and carefully done the results are anything but gratifying. It is a question whether the finished card made by this method ordinarily warrants the time and labor required in its production.

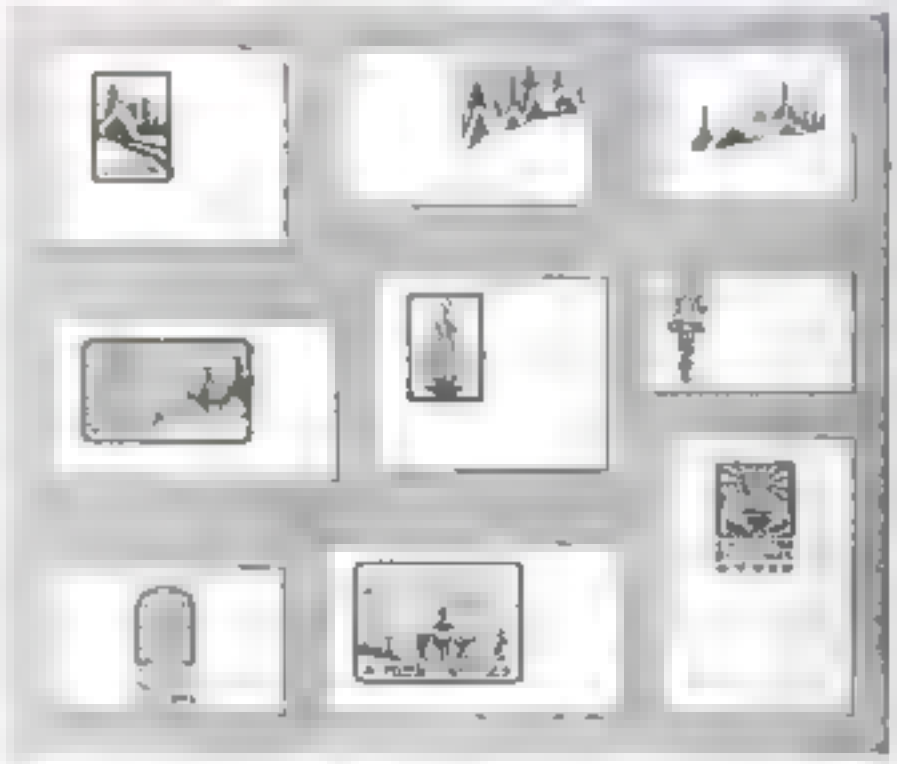
The accompanying illustrations show a simpler process for making attractive Christmas cards at very small cost. It is a stenciling method by which anyone can produce a number of attractive cards in a surprisingly short time. It has many advantages over other methods yet tried, but perhaps the greatest one is its speed and simplicity.

The design of a Christmas card should be in keeping with the season. Several suggestions are given above, although, of course, the originals contained a variety of colors as well as gold and therefore were far more brilliant than the reproduction.

These designs are large enough to be traced just as they are and transferred to the stencils. You may, however, prefer larger cards; and, indeed, larger designs are, within limits, easier to cut and handle. The originals were about twice as large as they have been reproduced.

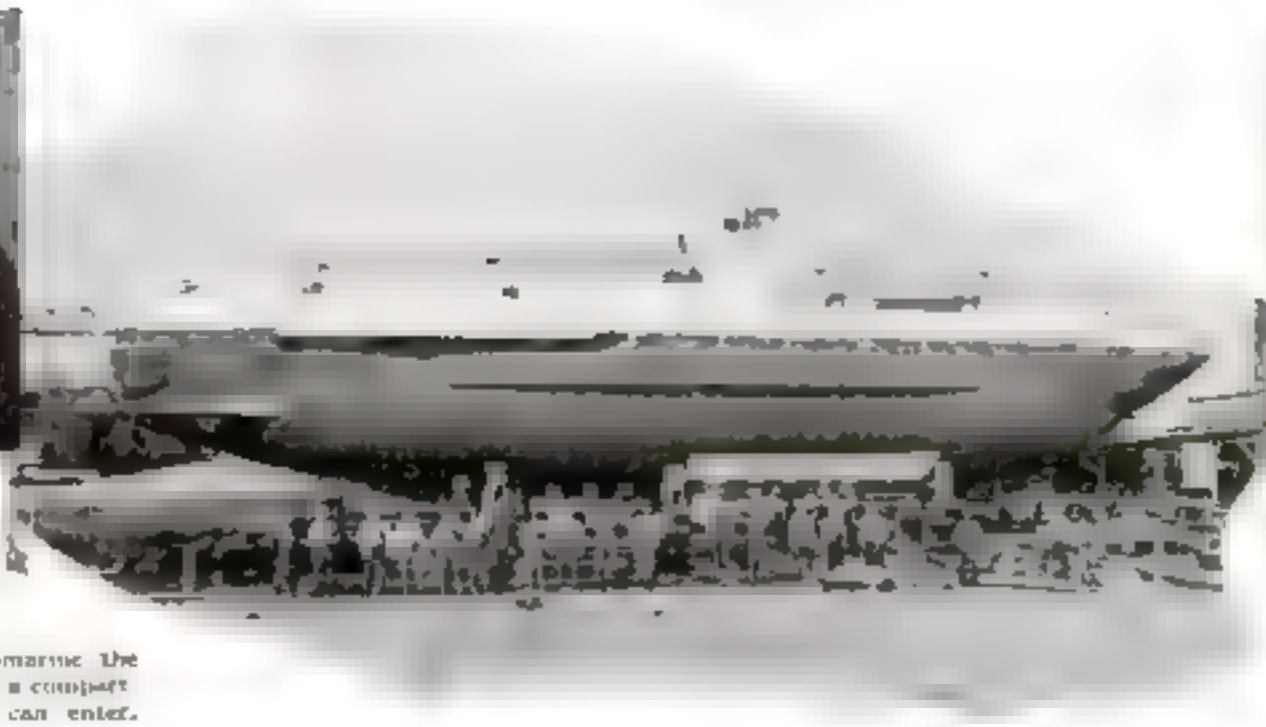
To enlarge a design, draw over it a series of horizontal lines ¼ in. apart and cross them with a series of vertical lines ¼ in. apart, or scratch a series of ¼-in. squares on a piece of celluloid and tack it over the design. On a sheet of paper, draw a series of either ½- or ¼-in. squares, depending upon whether you wish to make the design half as large again or twice as large. Now draw the design free-hand by placing in each ½- or ¼-in. square exactly what you see in the corresponding ¼-in. square of the design from which you are copying.

When a design is considerably smaller than the card upon which it is to be used



Thumb-nail sketches to indicate how the designs may be placed on correspondence cards and note paper of various sizes and shapes.

Navy diving hero who tested the rescue lung. Chief Torpedoman Joseph Kinsey



Simon Lake's rescue submarine the *Defender*. In its bow is a compartment submerged men can enter.

Lieut. C. B. Momsen, Navy diving expert wearing diver's breathing apparatus he invented and tested by making

Risking Death for Invention

Heroic Divers Brave Perils of the Deep to Test Newest Devices for Submarine Rescue

By ELLSWORTH BENNETT

Diver Jack Gardner emerging from rescue chamber of the *Defender*

WHEN three Navy divers, headed by Lieut. C. B. Momsen, crawled from beneath the rim of a diving bell 155 feet below the surface of Chesapeake Bay not long ago, they staked their lives courageously on the success of a new submarine rescue device which had been tried out for the first time in open water only a few weeks before. Yet their safe climb up a buoyed cable to the surface was a crucial test for which previous heroism already had paved the way.

The story of the Momsen "lung," which may play a major part in undersea rescue of the future, abounds with the exploits of brave men. Risking even death, they helped design and test the diminutive, two-pound breathing mask that, replacing cumbersome diving equipment, may spell safety for every undersea prisoner.

It is one thing to invent a submarine rescue device—and another to try it. Lieutenant Momsen, co-inventor of the "lung" with Chief Gunner C. L. Tibbals and F. M. Hobson, Naval engineer, did both.

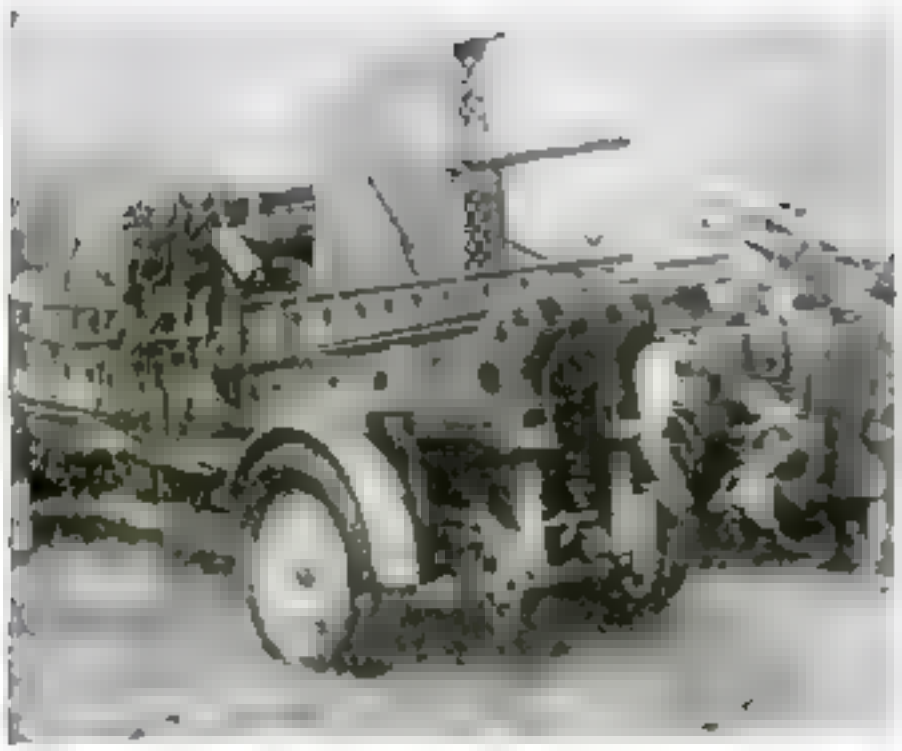
One of them sat in a round metal compartment, where the first episode in the "lung's" trial took place. Perched on a stool, in the Navy's compressed air test chamber, which can simulate the pressure of the sea at any depth, he breathed pure oxygen through a hose and mouthpiece. Doctors had warned him not to.

It was dangerous, they feared, to breathe the [illegible] gas under high pressure, such as a diver might experience more than thirty feet down. But the gage needle that showed the equivalent water depth of pressure in the chamber flickered around the dial to a hundred feet—a hundred and fifty—two hundred. Still the chamber's solitary occupant telephoned to watchers outside, standing ready to burst open the door and drag him out, that he felt no ill effects. The lung's" vitally important principle was vindicated: it could supply plain oxygen instead of compressed air, one of the essentials of the proposed device.

Next was a laboratory test now for a practical one. Would the diving mask work under water? At the Washington Navy Yard, men wearing the Momsen lung were lowered to various depths in a diving bell, from which they escaped and floated to the surface.

(Continued on page 138)

The submarine inventor, Simon Lake, (standing at left) watches diver demonstrate how submerged men enter his new rescue craft.



Speedy Antiaircraft Gun Joins Army's "Gasoline Brigade"

THE latest addition to the equipment of Uncle Sam's experimental mechanized army, described in a recent issue of POPULAR SCIENCE MONTHLY, is this new antiaircraft gun which can be rushed from place to place by the speedy truck upon which it is mounted.

The gun weighs more than eight tons and fires a three-inch shell. It is the largest piece of field equipment in the "gasoline brigade," which has set a pace for Army maneuverability. In a recent test, these implements of war were transported in record time from Fort Leonard Wood, Maryland, to Gettysburg, Pa.

The purpose of the experimental fighting body is to test the ability of new inventions to speed up the transportation of forces and large guns from distant points. At Camp Meade, Md., last summer, the "gasoline brigade," operating in all sorts of weather, demonstrated its superior mobility over horse-drawn units.

Button on the Dashboard Jacks Up the Car

HOW many times have you come to a bumping stop with a flat tire, wishing you could jack up the wheel merely by pressing a button on the dashboard? A new French invention makes this possible, according to the Automotive Division of the U. S. Department of Commerce.

A permanent jack in the form of a pneumatic piston and cylinder is attached to each wheel, being arranged so that its lower lifting end is on a level with the axle, while the car is running, in order not to decrease road clearance. In the cylinder a double telescope piston operates, allowing a relatively long stroke, and at the end of the piston is a broad lifting head. The first half of the operation, resulting when the button is pressed, thrusts the lifting head down to the ground and the second lifts the wheel.

World Growing Thinner?

THE world's belt tightened two miles in the last century! This is the conclusion of Professor Bruno Meyermann, of the astronomical observatory of the University of Goettingen, Germany. He says the distance around the equator has shrunk, since 1828, at least one and a half miles and perhaps as much as two and a third miles, as indicated by a slight increase in the speed of the earth's rotation. This, he contends, is evidenced by the fact that the day is shorter by a small fraction of a second each year.

The actual decrease in thickness of the earth, he computes, is less than three inches, but it is sufficient to alter the speed of rotation, so delicate are the balance of forces controlling it.

World's Record Speed Boat Goes 93 Miles an Hour

HURTLING over the water at ninety-three miles an hour, George Wood, brother of Gar Wood, famous motor boat racer, recently piloted his new speed boat *Miss America VII* to a world's speed record. This was his average speed for his six-lap dash over the one-nautical-mile course on the Detroit River. Two $10,000 engines, of twelve cylinders each, which make up the power plant of the craft, shattered the air with a deafening roar as Wood (left) and his mechanic, Orlin Johnson, crossed the finish line.

Stunt Flying No Cure for Deafness, Says Expert

THE popular idea that stunt flying will cure deafness is all wrong, according to Lieut. Col. Levy M. Hathaway, Flight Surgeon, Office of the Chief of the Air Corps, Washington, D. C. Defective hearing is common among aviators, he says, and instead of curing deafness, flying tends to bring it on.

The roar of unmuffled, high-power motors, together with the effect of rapid changes in atmospheric pressure on the delicate structures of the auditory apparatus, soon dulls the sense of hearing. Altitude flights and air maneuvers, practiced in an attempt to remedy deafness, are not only useless, he concludes, but may be actually harmful.

Flying "cures" are undoubtedly due to psychological effects on the subject under treatment, according to Dr. Paul V. Winslow, an ear specialist of New York City. Many slightly deaf persons, Dr. Winslow explains, think so much about it that they make themselves deafer than they really are. This psychological "deafness" may be remedied by mental stimulus such as a first plane flight gives, he says.

Teaching with Movies

STUDENTS in 15,000 schools in America see "movies" as part of their educational work. The Bureau of Education, Department of Interior, Washington, D. C., reports that many cities are equipping all new schools with portable projectors as well as larger ones in the main auditorium. This enables teachers to show pupils the actual scenes and processes they are studying. The result is the nearest approach to learning by travel that is possible for the average student.

Three reasons are given by the Bureau for the rapid increase in school movies. Safety film has done away with the danger of fire, satisfactory portable machines bring the pictures to the classroom, and improved mechanism enables amateurs to operate projectors without long training.

Lame Hunter Invents Swift Motorized Sled

BECAUSE lameness prevented Carl Eliason of Sayner, Wis., from keeping up with fellow hunters, trappers of the northern trails soon may substitute motorized sleds for sledge dogs and snowshoes. Eliason has invented a snow speeder which he says will do seventy-five miles an hour, and go anywhere a man on snowshoes can travel. The sled is powered by a two-cylinder motorcycle engine.

The inventor (front) with three passengers on his motorized sled. Propelled by endless tread, it is steered by moving front runners.

Porto Rico Grows a New Fruit—Sweet Lemons!

SWEET lemons may take their place beside oranges and plums as a table delicacy. A new variety, as large as grapefruit and sweet enough to eat without sugar, has been developed by growers in Porto Rico, it is reported. Another unusual quality of the fruit is said to be a remarkably sweet, penetrating odor. The lemons are being used as perfume in linen closets on the island. Cultivators of the new fruit claim that the flavor lasts as long as two months.

Novel Fire Rescue Tower Rises 220 Feet

A SUBSTITUTE for extension ladders and life nets for rescue work at fires is found in an ingenious new life-saving and hose tower invented by James A. Anania, of Harrison, N. J. Carried on a fire truck and raised by the truck motor, it consists of two telescoping parallel steel poles, each in five sections, and rising, when extended, to a height of 220 feet. They can be slanted at any angle.

Up and down the steel poles runs an elevatorlike steel platform, capable of carrying twelve persons, and kept level by balancing weights. The whole structure rests on a turntable by which, the inventor claims, it can be swung to a high window in ten seconds. The rescue platform is moved by steel cables running from a drum on the truck and passing over the top of the tower

The inventor demonstrates a working model of his ingenious tower for fire rescue work.

Shipping the World's Biggest Transformers

SPECIAL railroad cars of novel design had to be built to transport the world's two largest electric transformers from the Pittsfield, Mass., plant of the General Electric Company, where they had been constructed, to West Orange, N. J.

Flat cars with depressed centers solved the difficult problem of safely transporting the huge coils, one of which weighs 151,550 pounds. Each huge machine was slid onto the low-slung platform of the special car, where it was lashed firmly by guy wires stretched from the top of the transformer to the sides of the car.

At West Orange, engineers prepared special machinery to drag them to their destination in the switching station of the Public Service Corporation, located at the top of a mountain, where they are to be permanently installed. They are too heavy even for a locomotive crane to lift. Their size can be seen from the photo above.

Special railroad car for transporting largest transformer.

Latest Style Boxing Ring Rises Through Floor

"THE next bout of the evening will be————" Above the din of shouting fight fans crowding the arena of the new Dreamland Pavilion in San Francisco, Calif., the announcer bellows the names of contesting pugilists. Immediately, out of a large square hole in the floor at the center of the pavilion, appears a platform, rising like an elevator. It is the roped arena. The boxers are in their corners with their seconds, awaiting the gong. The referee stands in the center. At last the platform comes to rest above the floor. The gong rings, and the battle begins.

Such is the latest innovation in the fistic sport—the disappearing boxing ring. It has proved popular not only with the fight fans, but with the pugilists, for whom it saves the inconvenience of having to elbow their way through the crowds to reach the ringside. Now they can take their places, undisturbed, in the basement of the building.

When no boxing bouts are being held, the ring platform can be leveled even with the floor of the pavilion for dancing and other entertainment.

Seventeen-Year Locusts Due Again in 1936

ANOTHER brood of cicada, or "seventeen-year locust," will appear in 1936, according to J. A. Hyslop, of the Department of Agriculture pest survey. It will be brood number X which last appeared in 1919, when it spread through the central and eastern states as far south as Georgia.

The insects that appeared in certain eastern states last spring belonged to brood II. These noisy visitors, says Hyslop, are not, as is commonly thought, destructive to growing crops. Their only damage is a negligible number of leaves that fall from trees and shrubs because they have been slit by the female insects in laying their eggs. Steps are being taken by directors of a number of parks to preserve the unusual insects, which are in danger of being exterminated.

Tons of Waste Paper Go to Make Fireworks

SEVENTY million pounds of old newspapers went to the Orient and became firecrackers, among other things, last year. A five-million-pound shipment of discarded newspapers goes from Los Angeles each month to manufacturers in the Orient. They are used in making fireworks, toys, boxes, wall linings, and novelties in China and Japan.

The value of the year's export was $985,425, according to Commissioner S. S. Sandberg, of the U. S. Shipping Board.

Beetles Test Human Food

BEETLES have become "official tasters" for men, along with the white rat and the guinea pig. Workers at the Minnesota Agricultural Experiment Station, St. Paul, have begun using them in testing the effects of various foods. The short life-cycle of the insects and their rapid increase in numbers add to their value in such experiments, it is said.

Aluminum Replaces Copper in High-Tension Wires

COPPER, long the standard material for electric wires, is being replaced by aluminum in many new high-voltage lines, in spite of the fact that copper is a slightly better conductor of electricity. Aluminum wires can be greatly increased in strength by the addition of a steel core, enabling them to be strung more tightly. Moreover, aluminum wire has a greater diameter for the same weight than copper, due to its lightness, and the broader circular cross section reduces the electric leakage that occurs in high-tension lines at sharp angles and curves.

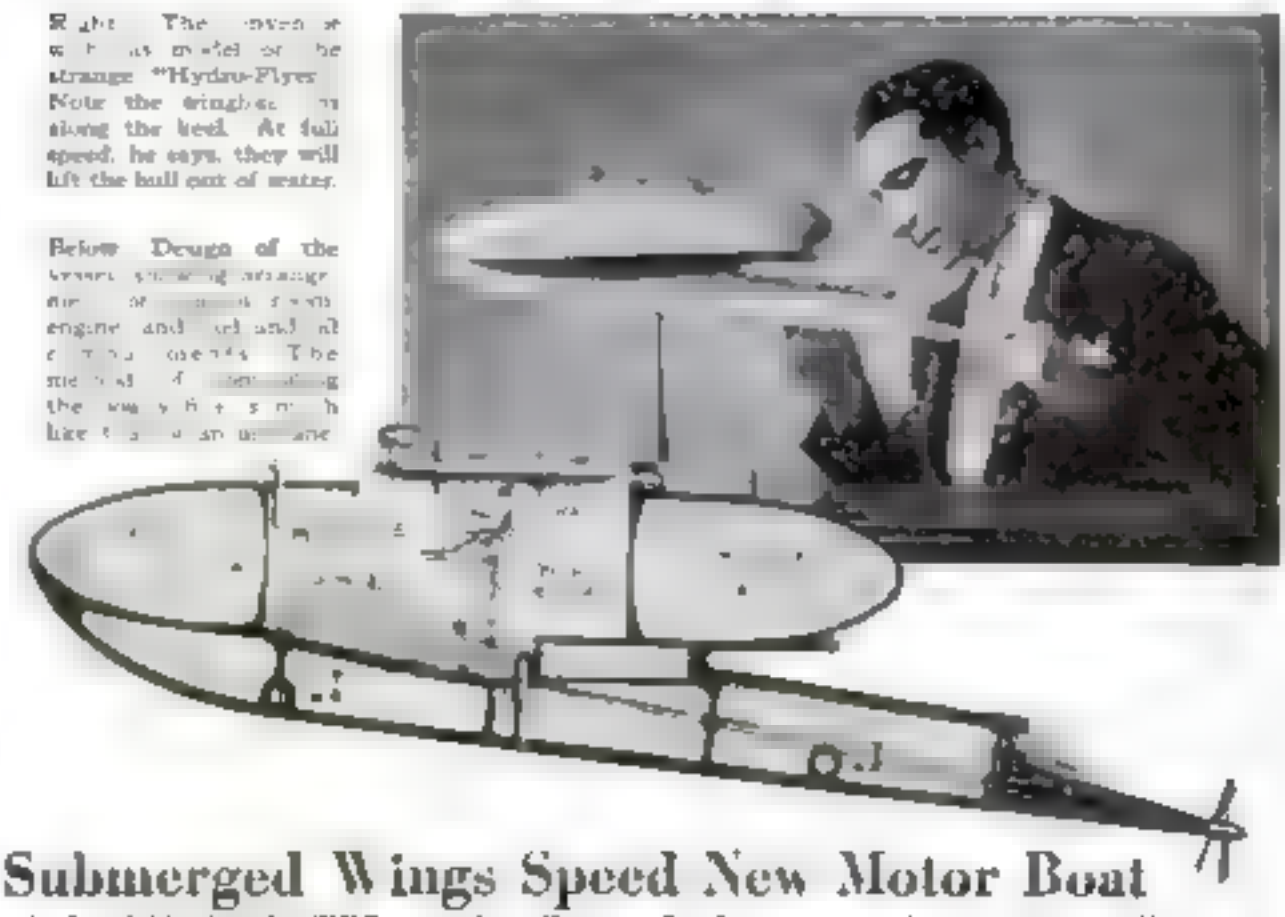
Planes Pick Up Mail on the Wing in Tests

THE idea for a device which will permit mail planes to swoop down over small towns along their routes and pick up sacks of mail without stopping was embodied in a small model of an invention made by Dr. L. S. Wagna, of Seattle, Wash., and pictured in the October POPULAR SCIENCE MONTHLY.

Now the device in full size has been tested successfully by pilots at a Seattle flying field. The plane drags an iron ball at the end of a wire into the wide open mouth of a large funnel-shaped trough, as shown below. At the narrow end of the channel, the ball catches the sack of mail or package which is released by a spring. It is then drawn up to the body of the plane as it speeds away. Another use for the invention would be the picking up of tanks full of gasoline, thus refueling the plane on the wing.

A plane picking up mail during [illegible] tests at Seattle, Wash. Like a fisherman, the pilot lets down a long wire with a hooked ball. The weight passing through the trough at his right snags the mail sack.

Right: The device shaped like a funnel with which mail is delivered. The weighted ball from the plane enters the funnel mouth, and passing to the narrow end, catches mail which is released by a spring.



Right: The inventor at work on the model of the strange "Hydro-Flyer." Note the fringe of fins along the keel. At full speed, he says, they will lift the hull out of water.

Below: Design of the vessel, showing arrangement of [illegible] engine and oil and air control [illegible]. The method of [illegible] the way it [illegible] like [illegible]

Submerged Wings Speed New Motor Boat

AN "UNDERWATER airplane" is the way Aldo Cursoni, of Larchmont, N. Y., the inventor of a curious "Hydro-Flyer" boat, describes an unusual finned keel he has devised to propel and direct the craft. When not in motion the boat a flat bottom, or plane surface, will rest on the surface of the water. But when the powerful engine begins turning the propeller at the end of the deep keel, driving the boat forward, the inventor says the wing-like, submerged fins along the keel will lift the main body of the vessel entirely out of the water, enabling it to attain great speeds by reason of the reduced resistance.

The pilot in an inclosed control room will guide the vessel by means of a control system similar to that used on an airplane. A rudder bar, operated by the feet, steers the boat to right and left, and a vertical lever operating the underwater fins regulates its up and down movements. Fuel is to be stored in large compartments at the bow and stern at each side of the control and engine room, while the oil supply is to be kept in tanks in the keel of the strange ship.

A full-sized craft embodying the new ideas is now under construction. The designer believes that the rocket principle of propulsion can be applied to the vessel.

Faster Planes Will Speed Up the Air Mail

PLANES with a top speed of 140 miles an hour, and a cruising speed of 130 miles, will speed up the air mail, according to plans completed by air mail operators with Post Office Department approval. Air mail now travels at about a hundred miles an hour speed. New night schedules [illegible] by lighting [illegible] San Francisco-Salt Lake City [illegible] and in clipping a whole business day [illegible] the time required to send a transcontinental letter.

Curtiss Falcon planes of a new type will carry the mail over the eastern half of the journey; Boeing planes modeled after Navy attack aircraft will be used on the western stage. These small, fast planes are to [illegible] exclusively; air passengers will travel in large cabin ships. This separation of mail and passenger service has been found necessary because of the [illegible] which [illegible] practically doubled in the first month of the new low rates.

Experts Reveal How Much You Can Lift Safely

HOW much weight can you carry—safely? Not more than forty percent of your body's weight, continuously—or as much as fifty percent, now and then—is the conclusion of British investigators, as reported by the Bureau of Labor Statistics. A couple of pails of water, weighing, say, forty pounds, is just about the safe limit for a man weighing only 100 pounds himself, although the load may be increased by a half if it is compact and easily handled.

The greatest carrying feat by a human being on record occurred in 1898, when P. J. McCarthy, at St. Louis, Mo., staggered sideways eight steps with a ton-and-a-quarter load on his back. Later he raised a stone-laden platform weighing 6,370 pounds with his back, but made no attempt to carry it. That no feats remotely resembling these should be attempted by the average man is emphasized by the British experts, who made their investigation in the interests of factory employees.

Machine Unloads 1,000 Tons of Coal an Hour

A THOUSAND tons of coal an hour poured out of the hold of the *E. M. Young*, a Great Lakes coal carrier, recently, when a new type of unloading machine set a record by emptying 8,000 tons from the hold in less than eight hours. The work, if done by manual labor, would have kept a gang of men busy for from seven to ten days

Huge scrapers in the hold of the vessel brought the coal to a chain of buckets. These carried it to a moving belt conveyor that passed over the side of the ship and piled the fuel on the dock in black mountains ready to be loaded into motor trucks and hauled away

The unloading device is moved from one end of the ship to the other, as the work progresses, operating down one hatch after another until the vessel is empty, ready for another cargo.

Twin Liners to Set New Records for Size

TWIN giants of the sea, each thirty feet longer than the *Leviathan*, are being constructed in Germany The liners, to be named the *Europa* and the *Bremen*, will measure nine hundred and thirty-eight feet in length, surpassing the longest ship now afloat, the British *Majestic*, by twenty-three feet.

This is the first time in history that two such giant ships have been under construction at the same time. It is expected that when they are launched, next April, they will be able to carry 3,000 passengers from Southampton to the United States in five days.

Their supremacy of the seas, however will be short-lived. As told in the September issue of POPULAR SCIENCE MONTHLY, the keel has been laid in Belfast, Ireland, for the 1,000-foot British liner *Oceanic*. When this super-vessel of the ship lanes takes the water, early in 1932, it will require a longer pier than any now in existence.

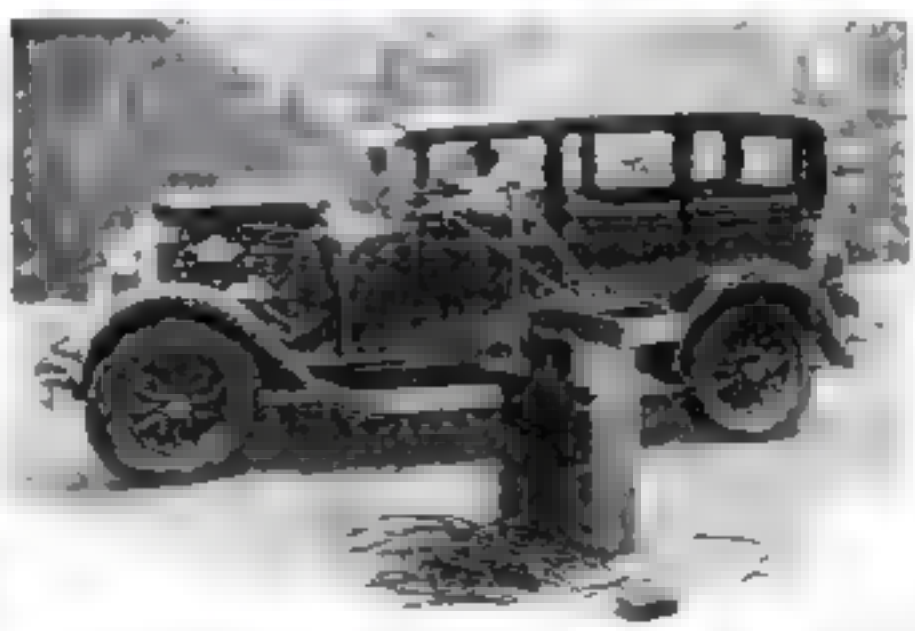
Waste from Stamps

A CURIOUS example of waste is the paper cut from sheets of postage stamps when their perforations are punched. Uncle Sam is seeking to sell these tiny disks of paper, which have been accumulating at the tremendous rate of four tons a month.

Auto Runs X-Ray Machine at Patient's Home

AN INGENIOUS traveling X-ray machine, which goes to patients who are unable to come to it and which operates from the motor of an automobile, has been devised by Dr Chester B. Moses, a member of the staff of the Deaconess Hospital Buffalo, N. Y.

The motor-driven generator, carried under the hood of the car, as shown in the photograph below, supplies the current. It is permanently wired to the instrument panel of the car, where Dr. Moses plugs in with a flexible extension cord connecting with the portable X-ray machine. The cord will reach from the street to any room of a house. Thus, patients unable to go to the hospital for examination can be given X-ray treatment and have X ray photos taken in their own rooms.



At the patient's house, the X Ray machine is run from the motor-driven generator seen under the hood of the car

Ship Turbines Do Work of Half-Million Men

IT WOULD take the combined effort of half a million men to equal the daily work done by the two turbines on the *Virginia*, the electric vessel recently launched at Newport News, Va

The turbines deliver 17,688 horsepower, which is about equivalent to the work of 185,724 men. But, as the working day for men is eight hours and the turbines labor twenty-four, to arrive at a true comparison we must triple the number of men, making it 557,172.

Invents Floating Turbine for Power from Waves

A NEW attempt to capture the restless power of ocean waves is seen in the working model of an ingenious scheme devised by George E. Faucher, a Los Angeles inventor. He plans a 1,000-foot "wave turbine pier" which he says will supply sufficient electricity for the needs of an entire city.

The invention is a "v"-shaped open-

The inventor with a small working model of his proposed 1,000-foot wave turbine pier.

work structure with a series of turbine paddle wheels along each side. The point of the "v" cuts each incoming wave in two, sending it along each side, spinning the wheels and generating electricity. The whole structure, says the inventor, is to rest on an air-tight float and will be anchored well off shore, so that high and low tides will not interfere with its functioning.

This invention is one of many attempts to take power from waves, tides, or differences of temperature in the ocean. The experiments of Dr. Georges Claude, French physicist who has generated electricity by using the differences in temperature between water at the surface of the ocean and at the depths to run steam turbines, was described in the October issue of POPULAR SCIENCE MONTHLY

Model Niagara Measures Flow Over Falls

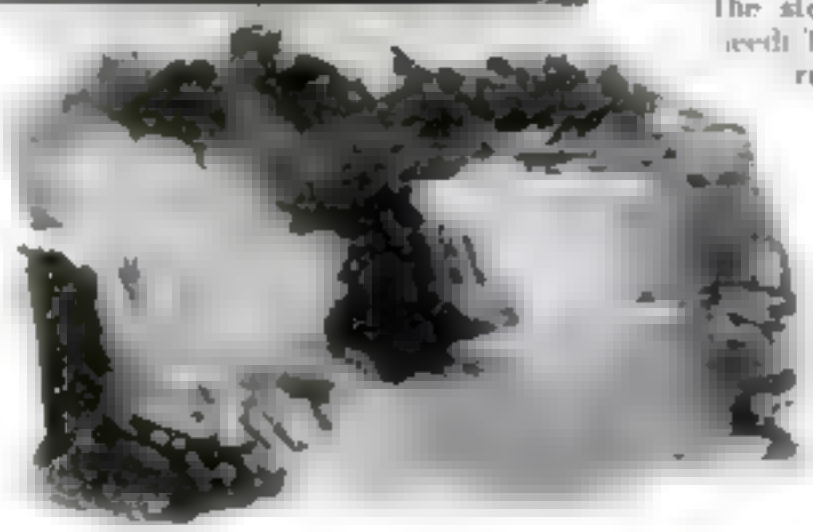
Above: Engineers testing effects of ice floes on the flow of the model Niagara. Right: Model falls after power diversion

CAN canals from the present amount of water be diverted from Niagara without marring its scenic splendor?

To answer this question for Canadian and American engineers, as well as for its own experts, the Niagara Falls Power Company has just completed the remarkable working model shown in the accompanying photographs. It reproduces faithfully the proportions of the actual falls, whose horizontal dimensions are reduced 100 times, while the vertical scale chosen is one to twenty-five, to emphasize depth. Running water in hydraulically correct quantities is fed by an electric pump. The entire model covers a third of an acre.

First the model was used to demonstrate the present appearance of the falls, with 50,000 cubic feet of water a second being drained from the river above them—a fourth of its total flow.

When twice this quantity of water was diverted, the flow over the Canadian or Horseshoe Falls crossed to the center, while the American Falls were left almost bare. When a dike was submerged in the river at a point above the falls, and artificial islands were inserted in the Canadian channel to distribute the water, both falls regained their former aspect.



Know Your World

TO TEST your knowledge of the world you live in, see how many of these twelve questions you can answer. Correct answers are on page 148.

1. How did icy Greenland get its name of "green"?
2. Where did wild elephants once live in the United States?
3. What government prohibits alcohol and tobacco?
4. Where is a city water supply pumped for more than 300 miles through pipes?
5. Where are railroad bridges built of bamboo?
6. Where does sarsaparilla come from?
7. Where was the ancient capital of the Inca Empire?
8. What island is called the "Gibraltar of America"?
9. What are the steppes?
10. Where is household hot water supplied by the sun?
11. Where are the greatest prehistoric ruins in the United States?
12. What is the highest town in the United States?

Super-Highways Proposed From Coast to Coast

TWO transcontinental motor speedways to span the United States from coast to coast would link East and West by automobile, in a remarkable plan that has attracted interest among engineers.

According to the scheme as outlined by R. A. Carpenter, chief engineer, West Chicago Park Commissioners, a 3,500-mile Northern Transcontinental Highway would connect Boston, Mass., and Portland, Ore., while a parallel 2,800-mile Southern Transcontinental Highway would join Savannah, Ga., with Los Angeles, Calif. Each would be 250 feet wide, and would be divided into four lanes—two outer drives sixty feet wide each for light traffic and two inside drives fifty-six feet wide for buses and trucks. Fifty-mile speeds could safely be maintained, he says.

The speedways would be elevated to cross all local roads and railways.

New Vacuum Tube Control Runs the Elevator

ELEVATORS are stopped exactly at the floor level with vacuum tubes like the ones in your radio set, in the latest control system perfected by the General Electric Company. Several tubes are mounted on each elevator car. When an elevator approaches a floor, the operator throws his lever to "off" position, but the car does not stop immediately. Instead the car glides slowly to rest, stopped at exactly the right place by means of electric coils installed in the shaft that actuate power relays through the vacuum tubes.

A similar device also using tubes, enables an operator to depress buttons on a panel corresponding to all floors at which the occupants desire to alight, and start up knowing that at each stopping floor a signal light and bell will remind him of the stop. With a combination of this and the stopping control, the operator needn't watch the shaft; he could run his car with his eyes shut.

Magnet Does the "Impossible"

THOUGH experience has taught that red-hot iron and steel cannot be attracted by even the most powerful electromagnets, a young electrician of a Newport, Ky., steel mill attempted the impossible—and succeeded! Now his five-foot magnet lifts tons of red-hot iron and steel ingots every day.

He discovered that if just the corners of the huge castings were allowed to cool, his magnet would lift the whole piece of red-hot metal and carry it through the air. Now the ingots are rushed out into the storage yard as soon as the molds are stripped off, and in a few minutes the magnet picks them up with no trouble at all, two of them at once, as you can see from the illustration below.

The five-foot electromagnet lifts two red-hot ingots at once. In order to make this possible, the corners of the castings are allowed to cool.

Molten Iron Poured from "Thermos Bottle" Car

MOLTEN iron, transported ten miles from the Hamilton Coke and Iron Co., Hamilton, Ohio, to the American Rolling Mill Co., Middletown, Ohio, is seen here being poured into a ladle from the remarkable car in which it traveled. Employing the principle of a thermos bottle, this car is able to keep metal in a molten state for as long as forty-eight hours, as told in the October issue of POPULAR SCIENCE MONTHLY. The car has been nicknamed "land submarine."

Hampered by Sun Spots

SUN spots, 93,000,000 miles away, affect the discovery of oil and minerals in America. This is the conclusion of Prof. George H. Peters, astronomical photographer at the Naval Observatory, Washington, D. C., who has made daily photographs of the spots for years.

In the oil and mineral fields, many investigators search for changes in the values of the earth's magnetism to reveal the presence of various formations underground. Sun spots are credited with causing frequent magnetic disturbances on the earth. During these magnetic storms, investigations in the field are valueless, and searchers receive telegrams from the observatory warning them when such disturbances are near.

Road Signs in Pictures

ROAD signs, in the universal language of pictures, are being introduced in Europe as an aid to international motoring, according to Pyke Johnson, American representative at the recent International Road Congress in Paris. Several European countries have adopted a code of pictures to replace words on signs at curves, bridges, and crossings. The plan will aid motorists to find their way where the language is unfamiliar.

Chinese Making Type for 10,000 Characters

MANY an American printer might falter at the gigantic task nearly half completed by a Shanghai printing establishment, which has been working for three years to make a complete set of type so that 10,000 Chinese characters—most of China's alphabet—can be printed. It will exceed by several thousand the number of characters now being used in the printing of the largest of Shanghai's Chinese newspapers.

Since a single symbol, in Chinese, may express a whole idea, an imposing array of type is required by the smallest printing establishment, and the newest alphabet, which will provide each of the 10,000 characters in five different sizes, will be a boon. Each "letter" must be photographed, and the impression from the resulting plate tediously tooled by hand. Four more years will be required to complete the work.

Is Man's Size Changing?

ARE we growing larger or smaller physically? Were men 5,000 years ago taller or shorter than the average man of today? To answer these questions, 200 skeletons taken from ancient Babylonian ruins on the island of Kish, in the Persian Gulf, will be measured. The results will be compared with the measurements of the people living in the same region today.

This comparison is expected to reveal whether the physical formation of men has changed. The skeletons, dating back to from 600 to 1,500 B.C., are being shipped to the Field Museum, in Chicago, where the examination will be made.

Know Your Car

MODERN improvements in automobile design and construction more than offset the tendency toward more rapid wear caused by higher engine speeds. The oil filter is one of the most important. The air cleaner is another.

With the oil filtered and dirt kept out of the incoming charge of gasoline and air, the oil in the crank case would retain its lubricating qualities almost forever if it were not for one remaining source of contamination. Dilution by unburned gasoline will, in time, rob the oil of its lubricating properties. In summer, when the motor starts promptly and heats to running temperature quickly there is little dilution, and the oil need not be changed very often, but in winter it should be changed frequently because excessive choking, slow warming, and low running temperatures greatly increase dilution. Cheap gasoline makes matters still worse.

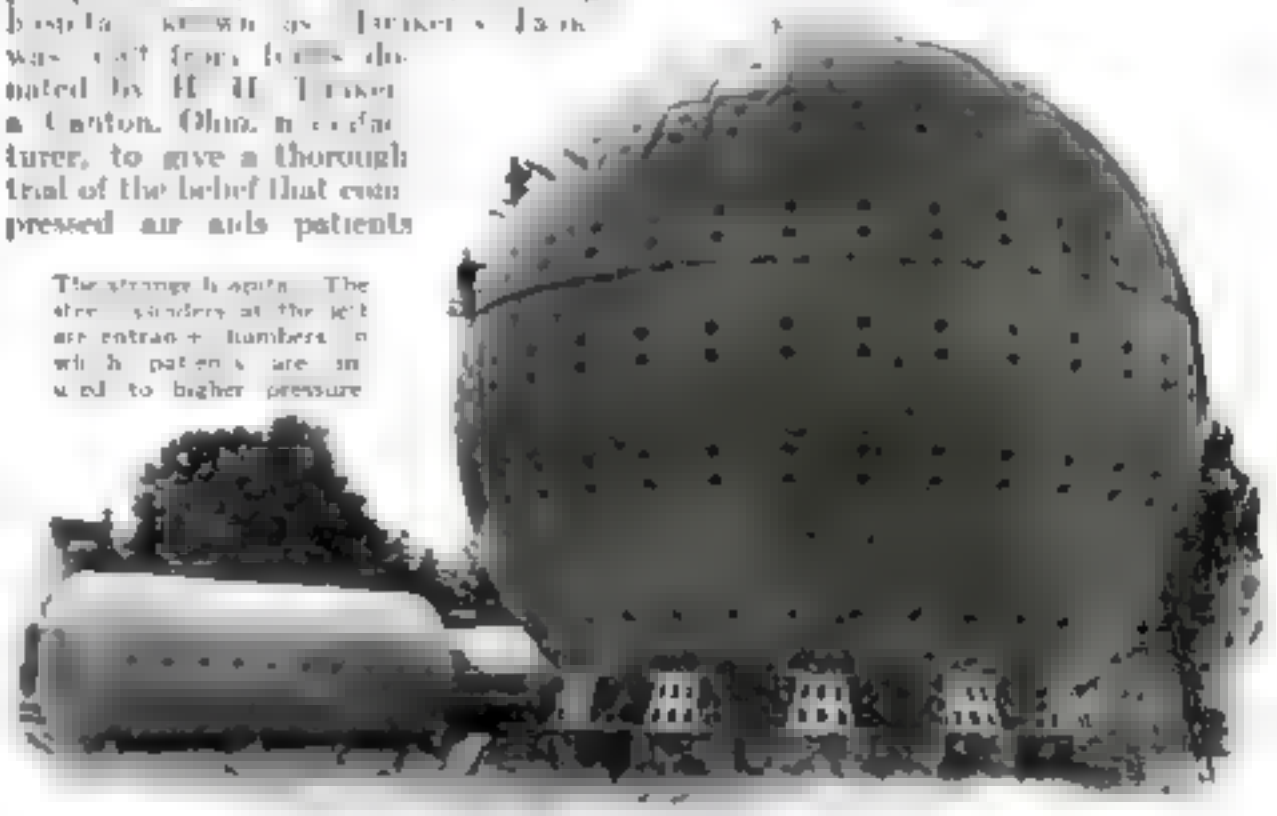
Birds Their Own Doctors

BIRDS that protect their own wounds with a plaster of down plucked from feathers are reported by a French naturalist. He says he has shot woodcocks and partridges that had unhealed previous wounds. In every case, the wound had been dressed with the down.

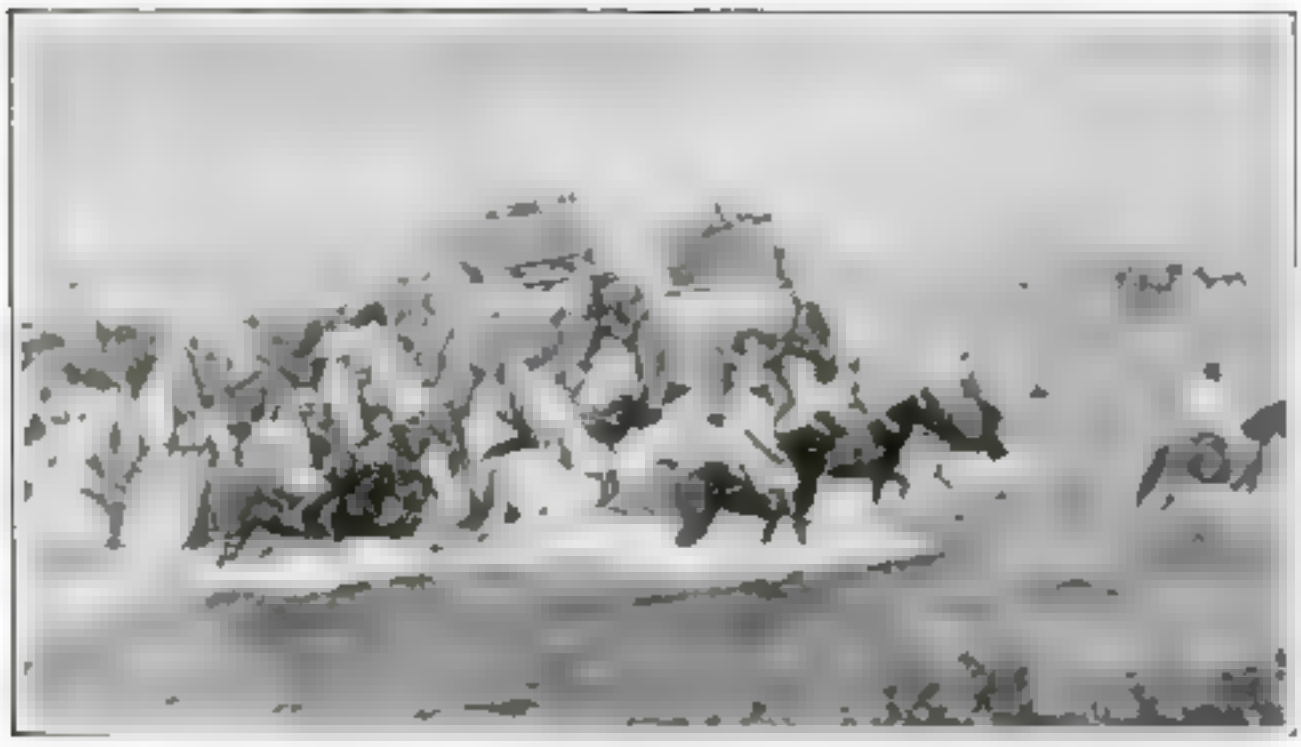
Huge Steel Ball a Compressed Air Hospital

A HOSPITAL, the shape of an orange, in which the patients, it is said, will live under a constant air pressure of thirty pounds, has been constructed in Cleveland, Ohio. The million-dollar steel ball is air-tight, and the pressure within will be maintained by powerful air compressors. Fresh air will be pumped in from the outside. The strange hospital, known as [illegible], was built from funds donated by H. H. Timken, a Canton, Ohio, manufacturer, to give a thorough trial of the belief that compressed air aids patients suffering from diabetes and other maladies. In tests the ball is reported to have been found leak-proof at twice the internal pressure it was designed to accommodate.

Steel cylinders form entrance chambers in which air pressure is slowly raised from normal to that within the globe.



The strange hospital. The steel cylinders at the left are entrance chambers in which patients are introduced to higher pressure



Afghan Ruler Plays Safe When He Hunts

WHEN the Ameer of Afghanistan goes hunting, almost everybody in his kingdom knows about it. His preparations assume the proportions of an army on the march. The Palace Guard turns out in force, armed as if to repel an invasion. The ministers and subordinate officials of the Ameer's court ride to the hunt with their monarch, and direct the affairs of the cavalcade.

The monarch himself sits high in the cushioned howdah of his favorite hunting elephant. An attendant handles the hunting guns, and loads and passes them to his master at the proper moment. It would be a hardy beast indeed that got closer to the Ameer than the Ameer wished. The photograph was taken as the Afghan ruler and his hunting party forded a stream on the return from the chase.

"Cannibal" Mosquitoes Are Barred from America

NO WAR will be waged in the United States between "cannibal mosquitoes" imported from France and our own flesh-biting variety—that is, not unless officials of the Department of Agriculture change their minds. The department recently refused to grant a permit to bring into the country any of the predatory French species which were expected to fight Long Island pests, as described in the August issue of POPULAR SCIENCE MONTHLY.

To tell the truth, Dr. S. A. Rohwer of the Department of Agriculture explained, his experts are rather wary of the so-called "cannibal." How can they be sure it would eat only other mosquitoes, and not attack human beings? In fact, they frankly express the opinion that the strange "beneficial" mosquito whose discovery in Brittany was reported by a French entomologist, Dr. Legendre, is actually no more than a variety of our common rain-barrel mosquito, with little of the nice discrimination in choice of diet ascribed to it.

Your Christmas Tree's Age

THE tree you set up at Christmas time and decorate with all sorts of ornaments takes from six to ten years to grow, according to the American Tree Association. Norway, red, and white spruce and balsam fir make the best "Christmas" trees.

The best trees for posts, the locust and oak, are grown in from twelve to twenty years; twenty-five to thirty years or more are required to produce poles.

Subways May Carry Mails

SUBWAYS may be added to the present mail-carrying network of airplanes, trains, steamships, and motors, according to the U. S. Post Office Department. Plans are being considered for dispatching sacks of mail over New York City's underground rapid transit system. If this cannot be done without holding up passenger trains while sacks are being loaded and unloaded, an alternate plan is to build a new subway exclusively for mail, possibly modeled after London's new automatic subway.

Arrest 219 Pilots for Air Traffic Violations

TWO hundred and nineteen pilots were arrested for breaking traffic rules of the skyways during the last year. Their offenses included taking-off or landing at airports in the wrong manner, low flying over congested areas, stunt flying with pay passengers, dropping heavy objects, carrying explosives, flying without a license, carelessness, and flying an overloaded machine. One pilot was caught smuggling aliens into the country in his machine.

The First Patented Rose

A NEW rose, "Lady Canada," recently exhibited in New York City, has just received a registered trademark from the Commissioner of Patents at Ottawa. According to its grower, it is the first flower ever patented in Canada, and probably in the world. The official protection gives him the sole right to use the name in the sale of cuttings and flowers of this variety.

Peanut Vines New Fodder

PEANUT vines are being added to the rations of farm animals. According to Dr. D. B. Jones, in charge of the protein investigation laboratory, U. S. Department of Agriculture, properly-cured peanut vines rival alfalfa and clover in feeding value.

Peanut meal, made from nuts from which some of the oil has been extracted, is being tried with good results as a hog fattener. When the animals were fed whole peanuts they often produced undesirable "soft" pork which does not command the highest market price. This tendency is said to have been overcome by feeding the meal, which retains its high percent of valuable protein but reduces the oil content.

New "Flivver" Monoplane for Beginners

Powered with a converted Ford auto motor, this $800 [illegible] The views show [illegible]

A MAN can run faster than the speed at which the newest "flivver" [illegible] to ground, according to its [illegible] North Carolina, builder. The [illegible] slow landing speed of twenty miles an hour, it is claimed, makes the machine unusually safe for beginners to use in practice. A converted Model T Ford engine powers the little plane, which is twenty feet long, with a wing span of thirty-one feet, and weighs complete only 500 pounds. In the air its cruising speed is fifty miles an hour. It was designed especially for sport and practice flying, and will sell for approximately eight hundred dollars.

This Car Runs with Water as a Lubricant

WHEN an Elyria, Ohio, motorist finishes filling his radiator, he lifts the hood of his machine and pours water in the crank case in place of oil to lubricate the motor. He says he has driven 137,000 miles since 1925 using only this unusual lubricant.

No graphite or grease is used and the continued operation of the machine, which is said to have made a trip from coast to coast, is ascribed to bearings made of a new metal alloy, and to specially designed pistons and piston rings. The alloy used in the bearings is the invention of E. M. Williams, of Elyria, Ohio.

Round-Up Nets 70,000 Rats in Ohio Factories

TWO hundred pounds of "hamburger," sixty loaves of bread, ten pounds of peanut butter, and forty-eight cans of salmon are being used in a rat round-up that recently netted more than seventy thousand rodents in various industrial plants situated on the banks of the Cuyahoga River in Cleveland, Ohio.

W. M. Anans, a rat extermination expert, working with the Cleveland Board of Health, directed the attack. The tid bits, sprinkled with an odorless, tasteless poison, were put in paper bags and scattered in the factory basements as though they had been discarded by workmen. Day after day the slaughter of the destructive rodents continued, until many thousands had been killed.

Huge Canal Locks Nearing Completion

EACH year some fifteen million tons of shipping will be lifted more than forty-nine feet as it passes between the thick concrete walls of the largest canal locks in Europe, now being completed near Hanover, Germany.

The new locks, said to be exceeded in size only by those in the Panama Canal, connect the old Mittelland Canal with the Hanover-Lehe Canal. They consist of two sets of locks, side by side, but operating independently of each other. Each is 738 feet long and thirty-nine and a third feet wide. The concrete work in the structure required about 427,000 cubic feet of material.

One of the immense concrete ship basins of the new German canal locks. It is longer than three city blocks and nearly forty feet wide.

Other locks, which will dwarf these monsters and even exceed the famous structures of the Panama Canal, are being built in Holland as part of the Zuyder Zee reclamation project. These giant steamship lifts will have a length of more than 2 000 feet, a depth of 104 feet, and will be eighty-one feet wide. The gates, to be of the sliding type instead of swinging, are being designed to admit the largest vessel likely to be built in many years. They will lead to the artificial harbor of Amsterdam.

French Airplanes Aid in Predicting the Weather

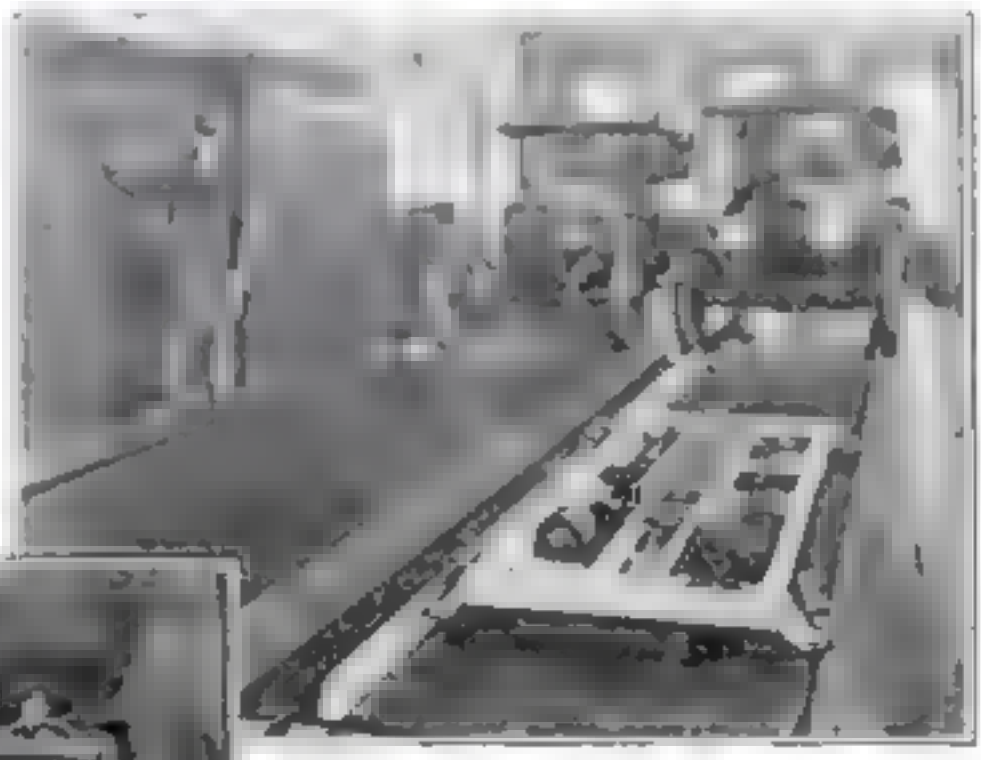
FLYING weather bureaus have been established in France to aid the Meteorological Bureau in their predictions. Three airplanes make regular observation trips aloft each day. One reports conditions over Paris, another watches the vicinity of Lyon, and a third ascends from Saint-Raphael, on the Riviera.

Gen. Delcambre, chief of the Weather Service, explains that lack of information about weather conditions on the sea and above the clouds cause inaccuracies in French weather reports. More planes will be fitted for aerial observations soon.

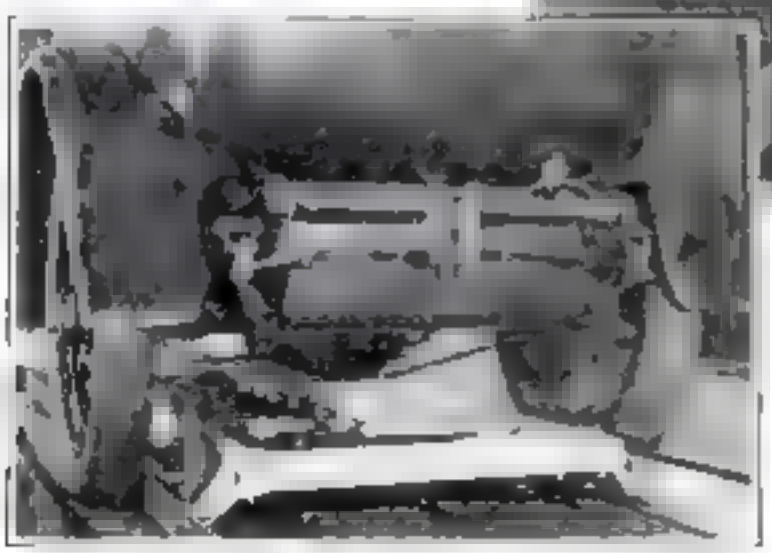
Electricity Parks Cars in Novel Garage

YOU drive in, stop your car facing an elevator, and electricity does the rest, parking the machine on one of the upper floors of an automatic skyscraper garage being built near the Grand Central Station in New York City.

An "electric parker" invented by Morton A. Kent, of New York City, is the heart of the novel plan. This is a low truck which runs on tracks under the automobile. From this truck rises a platform which catches under the rear axle housing of the car. It then hauls the car along grooved runways onto an elevator which whisks it to an upper floor where the "parker directs it to a vacant space. All is controlled by an operator who presses various buttons at the side of the elevator.



Merely by pressing a series of buttons the elevator operator parks the car on any floor of the building.



The "electric parker" runs on tracks under the car, and a rising platform catches under the rear axle.

After a car is installed, the owner takes the elevator to the upper floor, boards his car from the tracks, and drives off. The tracks from the floor of the garage to the entrance are flat. The elevator moves at two miles per minute and that in a rush 270 cars an hour can be handled.

Simplify Codes

THOSE who send cables in code will have to limit the words to five letters instead of ten, if the proposal considered by representatives of telegraph and cable lines on five continents, recently, is carried out. Code words in the past have been accepted under the condition that they could be pronounced in English, German, Spanish, French, Dutch, Italian, Portuguese, or Latin. Many of the ten-letter words cannot be pronounced in all these tongues and are subject to being held responsible for transmission errors.

The new proposal limiting the code words to five letters would call for an accompanying reduction in rates.

Queer Island Dog Kingdom Ruled by a Terrier

A lonely island, inhabited only by dogs, has been reported off the coast of Africa by French sailors, who believe the animals have descended from pets shipwrecked or abandoned there. The island, called Juan de Neva, lies in unfrequented waters between the African coast and Madagascar. So far as is known it has not been visited by ships for years. No one lives there, and the island has been considered valueless.

When the captain of a French vessel landed recently, he was faced by a large mongrel dog, evidently part terrier, who appeared to be the dog king of the island. When the captain threw a stone at him, the dog stood his ground, howling like a wolf. Immediately dogs appeared from all sides, according to the report, and forced the intruder, who was without weapons, to beat a hasty retreat

His Hobby Is Collecting Miniature Books

A Lilliputian library is the hobby of James D. Henderson, of Brookline, Mass., who has collected tiny volumes from all over the world. Among the little books, which he reads with the aid of a magnifying glass, is a complete edition of Shakespeare printed on pages little larger than postage stamps. A full set of Dickens, and a tiny Bible which rests on a desk only hand high, are other features of the unusual collection. The tiny size of some of the volumes can be appreciated by comparing them, and their miniature bookcase, with the book of average size standing on the table at the right of the picture below

The bookcase itself is a remarkable example of miniature furniture building. It is complete even to leaded glass doors.

The miniature library. Compare its volumes with ordinary book at right.

Radio and Airplane Aid in Missionary Journey

Radio will play an important part in a 240,000-mile missionary trip into isolated districts of Australia, led by the Rev. G. M. Scott, an Australian clergyman, whose party carries wireless sending and receiving equipment. Wherever he finds settlers requiring immediate help, the missionary will send a radio message to headquarters of the Australian Mission, and assistance will be sent by airplane.

Champion Radio Fan Uses Chorus of Speakers

One ordinary loudspeaker isn't enough for O. Manupe, of Palisade, N. J., owner of what he claims to be the most elaborate private radio apparatus in the country. This confirmed radio fan has fitted a large battle board to several dynamic cone-type speakers, so that he can get any volume from a whisper to a thunderous roar

He asserts that distortion has been reduced to a minimum, even at volume sufficient to shake the rafters.

French School Trains Women as Engineers

Only women are admitted to a new electromechanic institute at Paris—France's first exclusively feminine school of engineering. Its graduates will be as well qualified for high technical positions as male applicants, for its equipment is said to be as complete as that of any school in the world. Its founder, Mlle. Paris, is herself an engineer of wide experience.

The students receive thorough instruction, not only in the theory and principles of electrodynamics, but in construction and actual operation of electrical machinery. In their shop work they learn how to dismantle or assemble dynamos, generators, transformers, and so on, gaining first-hand knowledge of the function and operation of every part.

Girl students in France's first feminine school of electrical engineering. Mlle. Paris, the founder, is seen at the left teaching the students how to dismantle a dynamo, and how each part works.

Huge Indoor Ocean Beach Planned in Germany

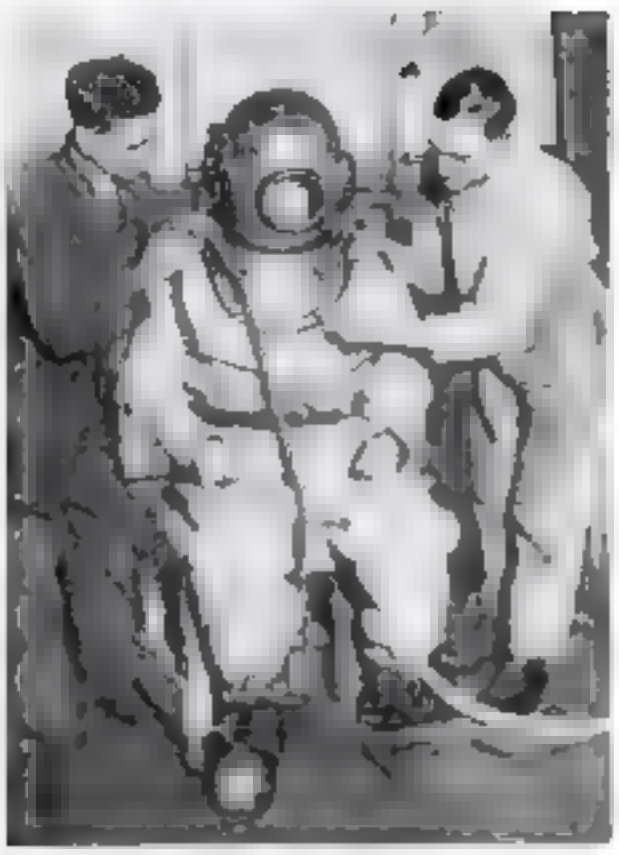
An imitation seashore, under a great dome of glass and steel is planned in Germany to provide winter bathing under summer conditions. In the center of the imitation ocean, a large sand hill will be surmounted by a restaurant where bathers may dine, wearing beach pajamas and imagining they are spending a holiday at Deauville or the Lido.

A "boardwalk" will surround the miniature ocean and the sandy beach will allow 1,700 people to lie in the sand and bask in artificial sunshine supplied by huge lamps giving off ultra-violet rays. The lamps will hang from the roof, 150 feet above the pool.

Professor Karl Stodieck, of the Technical College at Charlottenburg, suggested the unusual beach

Would Improve Auto Lamps

Automobile lamps constructed so that their light would be visible from all angles, is an improvement suggested to the Society of Automotive Engineers as a means of reducing the hazards of night driving. While the cowl lights on some makes of cars can be seen from the side, the lamps on most automobiles are visible only when seen head-on, especially when dimmed or in bad weather. Under some conditions of driving, such as in turning corners and on curves, for example, this causes the entire car to be invisible to other motorists on the highway.



Deep-Sea Diving Is Hobby of British M. P.

His colleagues may have their golf or shooting or whatnot for recreation but when Captain Sidney Streatfeild, Member of Parliament, wants to enjoy himself, he goes for a deep-sea dive. The British legislator has been a confirmed diver in his leisure time for the last twelve years, and has gone down as far as five fathoms. As far as hobbies go, the diving M P seems to be in a class by himself. The illustration above shows the diving lawmaker being fitted with a new suit of "sport" clothes.

Pumps Air into Brain for X-Ray Study

By pumping rarefied air into the brain, Dr. Max Ludin, director of the X-ray department of a hospital at Basel, Switzerland, has been able to uncover the exact location of tumorous growths through X-ray photographs. These pictures of the brain after the air has been pumped in, show the healthy cells as white stains and the diseased ones as almost black.

In locating growths in the spinal column, Dr. Ludin injects, instead of air, a fluid that photographs well. This fluid runs down the spine until it is stopped by the growth. An X-ray photograph thus reveals the exact location of the diseased portion of the spine and simplifies the physician's diagnosis.

The Sky's Blue Measured by New Color Chart

The blue in the sky is being measured by an ingenious color chart prepared by a German physicist and color expert, Professor Wilhelm Ostwald. It contains all the sky colors, from the bluest known to almost colorless gray. By comparing the colors of the chart with that of the sky, and picking out the shade that most nearly matches, the amount of blue in the sky can be determined, says Professor Ostwald.

Eskimos in the polar regions and aviators high in the air are said to see the bluest skies. The United States Weather Bureau, in Washington, D. C., reports that the blueness of the sky depends upon the amounts of dust and moisture in the air. After a rain the sky is bluest.

Metric System for China

The latest convert to the metric system is China, whose Nationalist Government recently replaced the old measurement standards with the system used in practically all countries except England and the United States.

His Keen Ears Test 250 Loudspeakers a Day

Both radio loudspeakers and radio amplifiers for phonographs are tested for tone by comparison with a master speaker unit over their entire musical range, in the experimental laboratory of a Chicago radio manufacturing concern.

One of the expert testers, Martin T. Olson, is said to have tested more than half a million speakers, averaging 250 every day for almost eight years. An accomplished musician, he has developed sensitive ears that can recognize sounds as high-pitched as 10,000 vibrations a second. Such sounds are inaudible to the ears of the average person.

Martin T. Olson testing the tone range of a new loud speaker. He can recognize sounds most of us can't hear

Huge Flying Sign Flashes from 2,000-Foot Height

A huge electric sign, ninety feet long and six feet high, circled in the sky 2,000 feet above Broadway, in New York, recently, testing out a new form of advertising: the airplane signboard. Flaring red letters, taking up the entire lower wing surface of a giant bombing biplane, alternately flashed the name of an advertiser and his address.

The roar of the plane's three motors, totaling nearly 1,000 horsepower, attracted the attention of the theater crowds below. The power for the sign was generated by dynamos which occupied most of the space in the cabin of the plane. They are capable of producing 7,000 volts. The letters giving the firm's name and its address were superimposed upon each other in order to permit the change in the wording of the sign.

Since the sign was not visible to the pilot or the electrician in the cabin of the plane, small lights on the edge of the wing, each connected with one of the letters, indicated that it was flashing.

Explains Why Actors Are Free from Paralysis

The reason few actors have paralysis is because they give their emotions exercise! This is the conclusion of Dr. Julius Heller, of Germany, after an investigation of the causes of death of more than 1,400 actors. Only one and a half per cent of the group studied died of paralysis. This percentage is much lower than that of any other professional group investigated.

People in ordinary walks of life, Dr. Heller explains, have to repress their emotions more than actors, so part of their nervous machinery atrophies from disuse. This tends to make them more susceptible to paralytic attacks.

Boy of Eleven Builds Prize Model Plane

A model of a tri-motored monoplane, almost as long as the builder, won for Tony Verlatti, an eleven-year-old San Francisco boy, first prize for the most interesting model shown at a recent tournament in that city. The builder named his white monoplane the *City of San Francisco*.

How would you like a ride? Tony Verlatti, age eleven, shows a girl friend the prize winning model monoplane which he built.

The First Coin

Only four known specimens exist of what is believed to be the first coin ever minted—a Greek gold drachma which experts think was struck off about 700 B.C. One of these in the collection of J. P. Morgan, New York banker, is conservatively valued at $3,500.

Strange Glasses Turn the World Upside Down

SIDEWALKS seem to hang above your head, people appear to walk with their feet in the air, and clouds and buildings change places when you put on the strange "upside-down glasses" with which students at Clark University, Worcester, Mass., are being tested

Wearing the inverted vision lenses, Norman L. Munn, a graduate student at the university, made a two-weeks test during which he saw only a topsy-turvy world. At the end of that time he prepared a report of his experiences. This will be used as a basis of study by the students in the psychology classes of the university to determine the effect of inverted vision upon the coördination of the senses.

Out for a walk in the upside-down world. A student tests himself with the odd glasses.

Huge Cone Loudspeaker Covers a Ceiling

THERE'S plenty of music in the air when programs come from a huge cone loudspeaker which takes up almost the entire ceiling of a room in the home of a radio enthusiast in Oak Park, Ill. It serves a purpose both useful and ornamental From its center is suspended an overhead lighting fixture. It is said to reproduce radio programs perfectly.

Hung from the ceiling, the enormous cone speaker is useful and ornamental.

U. S. History Recorded in Postage Stamps

A "NORSE-AMERICAN" series of stamps, commemorating the arrival in America of first immigrants from Norway in 1825, is the latest of many depicting the history of America, according to the Post Office Department. Twelve previously issued begin with the Columbian Series of 1893, illustrating the discovery of America, and include the Victory stamp of 1919, celebrating the ending of the World War, 1920's Pilgrim Tercentenary issue, the Huguenot-Walloon series of 1924, and the Lexington-Concord issue of 1925

Special stamps commemorate other events—the 1926 Battle of White Plains stamp, the 1927 Burgoyne Campaign stamp, and the 1927 Vermont Sesquicentennial stamp. Occasionally individuals have been honored by a stamp issue, as the Ericsson Memorial Stamp of 1926 for the *Monitor's* Civil War builder. A special air stamp was issued as a tribute to Lindbergh's New York-to-Paris flight.

Safety Tunnels

UNDERGROUND subways or passageways for pedestrians at dangerous street intersections in Highland Park, Mich., have proved so successful that plans for additional tunnels are under way. School children using two subways already provided are able to cross busy streets in safety.

Meanwhile similar tunnels tried out in Los Angeles, Calif., and described in POPULAR SCIENCE MONTHLY, have been welcomed by auto-shy pedestrians.

Largest Magnet Is Heavier Than a Locomotive

THE world's largest magnet, a 120-ton monster that weighs more than many a locomotive, has recently been completed at the Bellevue laboratory of the French National Research Bureau. Resting on massive pillars, it will aid in important researches in light, electricity, and radioactivity.

Torrents of water cool its huge copper coil, which carries a terrific electric current of 3,000 amperes—enough to light, say, six thousand ordinary lamps. According to the designer, M. A. Cotton, it can maintain its powerful magnetic field unabated for hours, if necessary, during prolonged experiments.

Painting the Towns Red

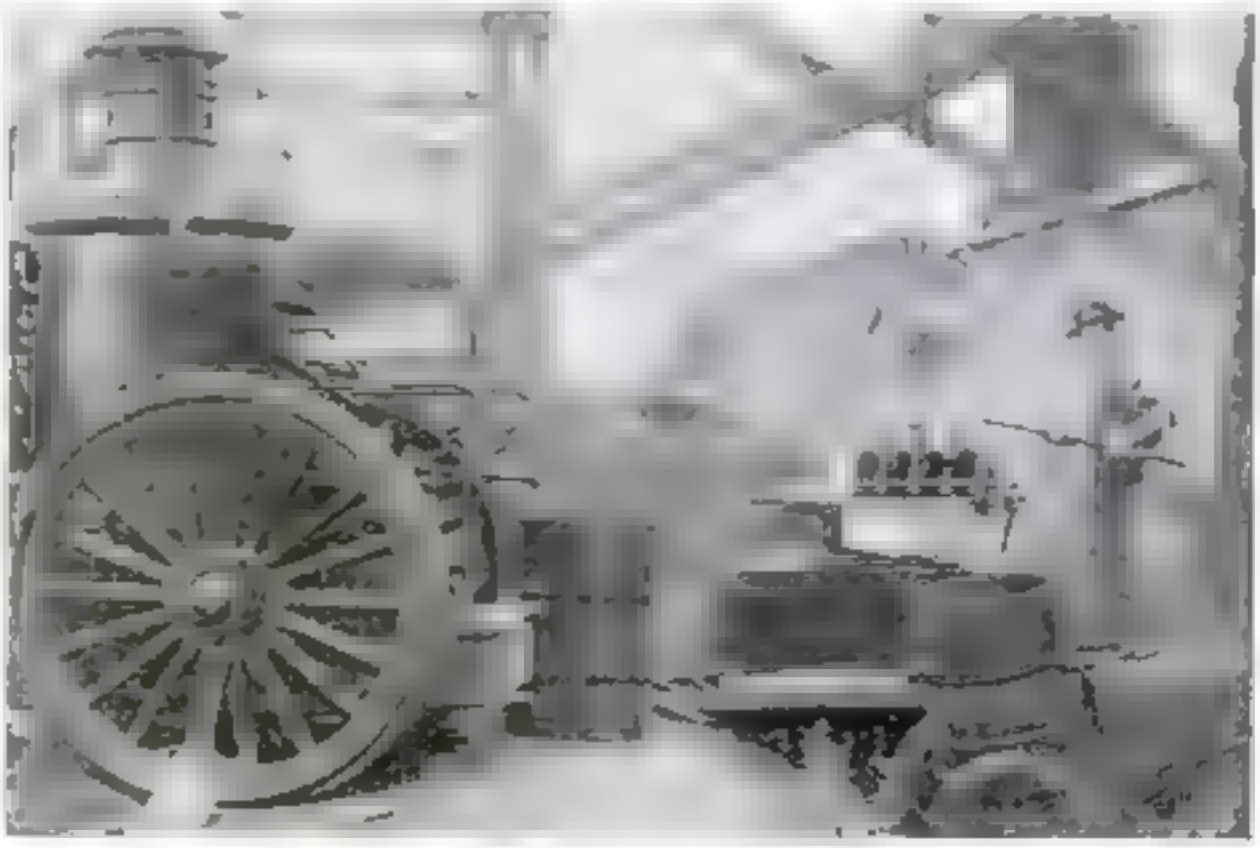
AN UNUSUAL donation received by the Lapland Geographical Society is a recent anonymous gift of red paint—$1,500 worth. The nameless donor specified that it was to be used to paint farm houses along the Torne River valley, in northern Sweden, so that the color-dotted landscape may set an example to dreary Finland homesteads across the border.

The Society has distributed the paint and now the valley dwellers are painting their towns red.

Old Fire Engine Has Job Cleaning Plane Motors

CLANGING dashes down the street behind galloping horses are over for the old-fashioned fire engines, but one has found a job on an aviation field in St. Louis. It has solved the problem of cleaning dirt and grease from airplane motors that are to be overhauled.

The old boiler produces the steam that is sprayed over the motors under high pressure, the steam being carried to the work through a long flexible hose terminating in a nozzle held by the mechanic. The new application of the discarded apparatus saves the workmen the labor of cleaning the motors with rags.

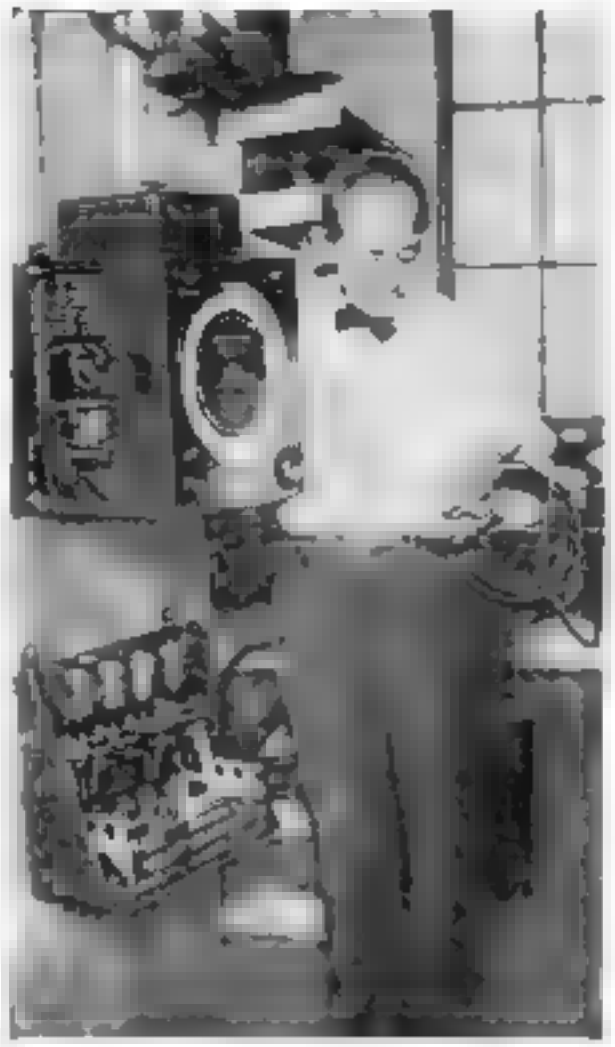


Steam generated by the old fire engine cleans grease and dirt from airplane motors in the shop.

An Improved Depth Finder for Coast Survey

ECHOES from the sea bottom are enabling the U. S. Coast and Geodetic Survey to map the ocean floor along the Atlantic seaboard more accurately and speedily than ever before, through the use of an improved "fathometer," or sonic depth finder, developed by Dr. Herbert G. Dorsey.

From the bottom of the survey vessel, the instrument sends out continuous sounds, and catches the echoes as they rebound from the ocean floor. Since the speed of sound is known, the elapsed time between the sending of a sound and the return of its echo is a measurement of the ocean depth. This measurement the sensitive instrument records on a dial. Recently a cable ship with the new sonic depth finder surveyed the ocean floor from the Azores to Newfoundland in the record time of seven days. Part of the time it made continuous soundings while steaming at full speed.



Dr Herbert G Dorsey with the apparatus used in his improved ocean depth finder.

Lamp Burns for 23 Years

WHEN "Lindy" was three years old, a 200-watt electric light bulb was screwed into a socket in the window of a Grove City, Pa., store. It has been on the job ever since, giving continuous light for twenty-three years. Another similar lamp, installed at the same time, burned out only recently. Both of these old-timers have been presented to Thomas A. Edison.

Builds Auto from Parts of Twenty-Seven Others

TWENTY-SEVEN standard automobiles contributed parts to a miniature homemade car in which the builder, Charles R. Gifford, of Tampa, Fla., intends to tour the United States.

The midget machine, pictured below is less than three feet high and weighs 1,200 pounds. It has a sixty-eight-inch wheelbase and a forty-inch tread. In tests it is said to have shown speed of sixty five miles an hour

Over Mt. Blanc by Air

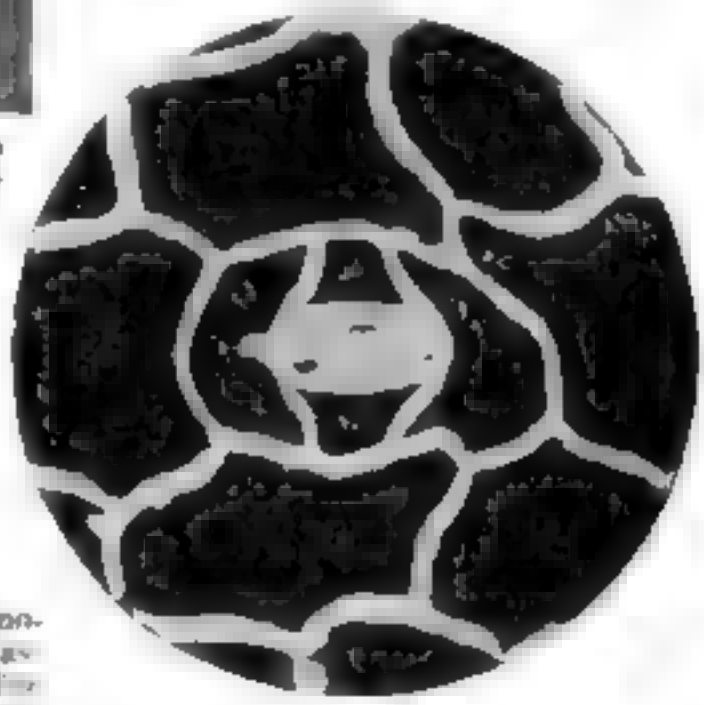
A BIRD'S-EYE view of the highest mountain in Europe, the famous Mount Blanc, is now provided travelers through the inauguration of a French sightseeing air line circling the peak. The aerial buses are two-passenger cabin planes that fly at an altitude of 14,000 feet, mounting from an air field near the railroad leading to Chamonix, France, from which most of the ascents on foot have been begun. The planes fly at scheduled times, and reservations can be made in advance.

The hour-and-a-half flight circling the 15,782 foot pinnacle of the mountain, costs about $20. A shorter flight over lesser peaks at an altitude of 8,800 feet taking about fifteen minutes, costs $8.50.

Interior Tides May Slow Down the Earth

THAT the earth's interior, like its oceans, has tidal movements is the theory advanced by Prof. Benjamin Boss, of the Carnegie Institution, to account for the known fact that the earth is slowing down and its days growing longer at the rate of about one second every 100,000 years. Originally friction of the ocean's tides across the bottom of shallow seas was believed solely responsible, but this, Professor Boss says, could cause only two thirds of the observed slowing. Tides within the earth would account for the difference, is his suggestion.

Apparently, he adds, there is some relation between the erratic speeding up and slowing down of the earth from time to time—a recent discovery credited to Prof. E. W. Brown, of Yale—and earthquakes. If this can be definitely established, Prof. Boss sees the possibility of advance warnings of severe earth tremors.



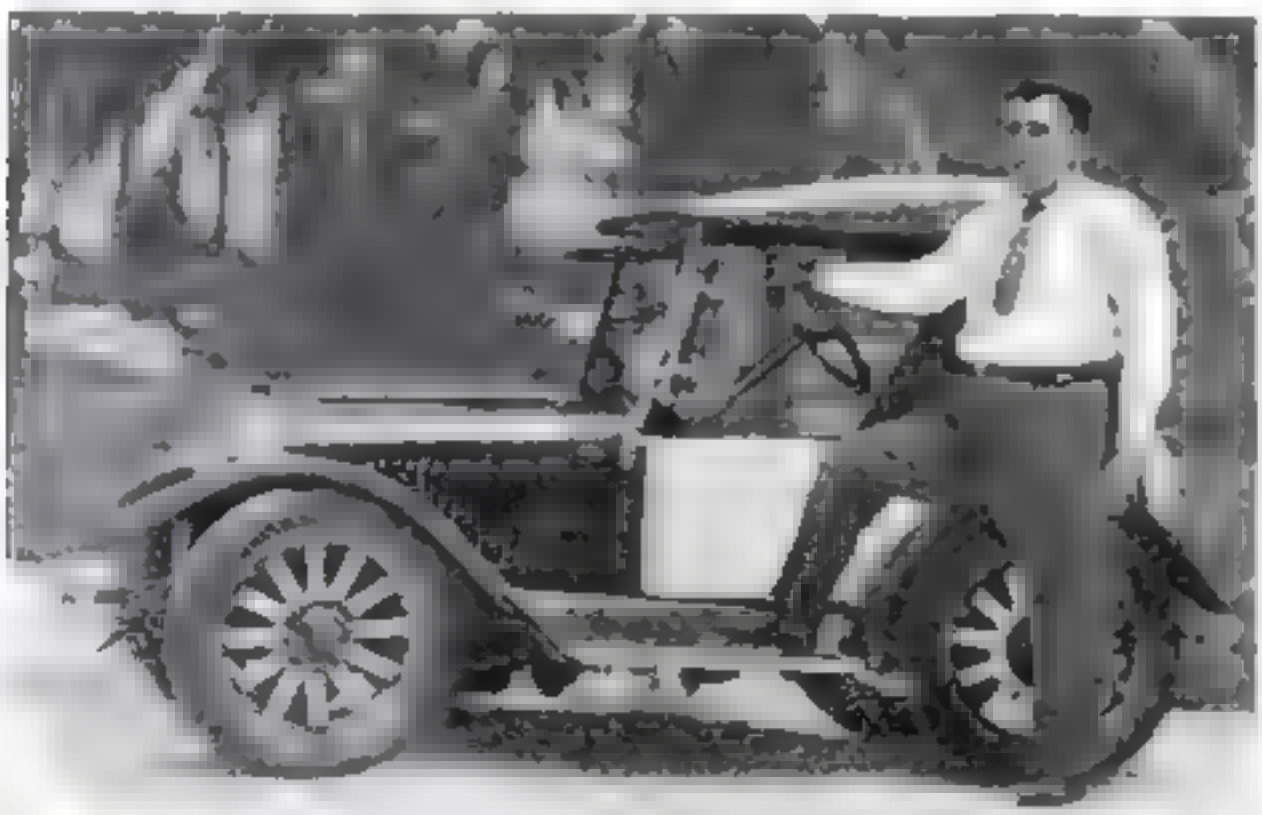
"Lungs" of Leaf Revealed in Motion Pictures

LIKE animals and human beings, leaves have lungs or they would suffocate. The "stomata," as the breathing cells are called, absorb nourishment from the sunlight, the rain, and the air. How these cells work is revealed remarkably by a recent English moving picture film called "Secrets of Nature," which presents highly magnified pictures of the leaf's breathing organs. The view above shows the structure and arrangement of the cells. At nighttime or in bad weather they close up and wait for the sun to shine again before they open. Then they work feverishly to make up for the time they have lost.

New Cloth from Plants

SOON you may be wearing clothes made of kendyr. That is the name of a fiber plant, discovered recently growing in large quantities in Asia, and found to produce textile yarn of high quality. A cloth made half of kendyr and half of cotton, tests show, is attractive and durable.

Two tons of kendyr a day is to be turned into cloth by a new machine built especially for the purpose.



The auto mongrel and the man who built it. It is made of parts of twenty-seven different cars.

Odd Machine Plays Sound Effects for the Movies

MERELY by pressing a button almost any imaginable sound can be produced on this machine, according to its inventor, A. W. Nichols, of New York City. He is seen assembling the complicated mechanism designed to make movies more realistic. It is equally adaptable to drama and news reels.

He says his invention, on which he has worked for twenty-five years, can be played as simply as an organ. When a train rounds a curve in a picture, the operator presses a button and a realistic railroad whistle results; when an auto comes to a sudden stop, a shriek of brakes accompanies it as another button is pressed. The mechanism is operated through electric motors.

Canadian Tar Sands Tested for Roads

IN THE far Athabaska country of western Canada, famous in stories of the Royal Northwest Mounted Police, tar sands are being mined to make roads of a new kind in the Jasper National Park, Alberta.

Over gravel roads, the bituminous sands are spread to a depth of about two inches and form a layer similar to asphalt. These sand deposits along the Athabaska River have long been thought to contain possibilities for road building, but this is the first practical test to which they have been subjected.

Whalers of the Antarctic Aided by Wireless

WHALERS who go down to the sea in ships are taking science with them. The vessels, putting out from the South Shetland Islands into the Antarctic Ocean, are being equipped with wireless to direct the operations of the small boats that leave the mother, or "factory" ship, in search of quarry.

One of the greatest dangers of whaling in the past has been the possibility of becoming separated from the mother ship during a fog or prolonged snowstorm while pursuing whales in a small boat. An example of the value of this method of communication between the large vessel and its brood is found in the wrecking of the *Southern Queen*, a large Antarctic whaling ship. When it struck a submerged iceberg and began to sink, all the small boats were immediately notified by radio. The fleet of whale catchers hurried to the ship's assistance and took off all the members of the crew in safety.

Chemists Trace Source of Ancient Copper Weapons

DETECTIVE work by chemists recently trailed the copper used in ancient Mesopotamian weapons to the mines where it was obtained. Archeologists wanted to know where the men of Sumer, oldest of Mesopotamian kingdoms, got their copper. Inscriptions on bricks failing to tell them, they sought help from the metallurgical chemists. These men examined the copper of the old weapons, comparing it with specimens from Persia, the Black Sea region, Cyprus, Egypt, and other neighboring countries to see if they could find the same impurities. At last, in copper from mines on the Arabian Peninsula, near the Persian Gulf, a similar amount of nickel in the metal was discovered.

Mechanical Pole Setter Does Work of Twenty Men

ROCKY hills or marshes filled with underbrush are boulevards to this ingenious new machine for erecting telephone poles. It can go anywhere a man can walk. Perched on the brink of a precipitous incline, it swiftly bores a seven-foot hole in the earth; then a derrick at its business end swings a forty-five-foot pole boldly into position and drops it upright.

In a recent test the whole operation averaged less than six minutes for each pole. Only three men are required to run the continuous-tread juggernaut, though it does the work of twenty.

Seasick for Twenty Years

HALF a million miles on shipboard, and seasick every voyage, has been the strange experience of James Barger, a six-foot, two-hundred-pound sailor who has been in the U. S. Navy for twenty years. He has circled the globe three times.

Ink and Stain Made from Sequoia Seed Cones

ARIVAL of the seventeen-year locust is the giant Sequoia tree of the Pacific slope, which sometimes retains its seeds for sixteen years before dropping them from the cone. These trees are in no hurry. They are called the oldest living thing on earth. Some of them are believed by scientists to be more than three thousand years old.

An interesting method of protecting the seeds from weather and insects during their long wait is a coating of waterproof and germproof gloss which covers the cone. A recent experiment with this gloss showed that when it was removed from the cone and dissolved in water it made a good writing fluid or furniture stain of a rich maroon color.

New Roads, 10,753 Miles

A ROAD stretching from Gibraltar to within 600 miles of Yokohama could be made with the new highways under construction in the United States during 1928. The Government reports that the total mileage of these new roads came to 10,753, costing the states and nation $204,000,000. Since 1917, 71,484 miles of new roads have been completed and opened for motor traffic.

Unusual Locomotive Uses Its Steam Twice

THE unusual photograph below is a head-on view of one of the twenty new-type locomotives recently put into operation on the Boston and Maine Railroad. Two unique features are the placing of the bell above the pilot instead of overhead and the feedwater heater which forms a cowl in front. This device saves nearly fifteen percent of the fuel by utilizing the exhaust steam to warm the water before it enters the boiler, thus cutting down the length of time necessary to generate steam.

Front view of the curious locomotive, showing cowl formed by the novel feedwater heater.

Mountains Commit Suicide With Volcano Blasts

A VOLCANO is a mountain committing suicide. This unique definition is suggested by the National Geographic Society which says the mountains of the South Pacific are destroying themselves with volcanic activity.

The virtues of a volcano outweigh its vices, it is pointed out. Without such vents, the energy pent up for long periods might cause havoc over large areas.

The United States is said to own one fourth of the 417 active volcanos of the world. However, the only active crater in the country is Mt. Lassen, in northern California. Kilauea, the Hawaiian vent is called the most active volcano in the world. Into the huge crater of another volcano in Hawaii, Mount Haleakala, half the District of Columbia might be dropped.

Model Plane Sets Record for Weight Lifting

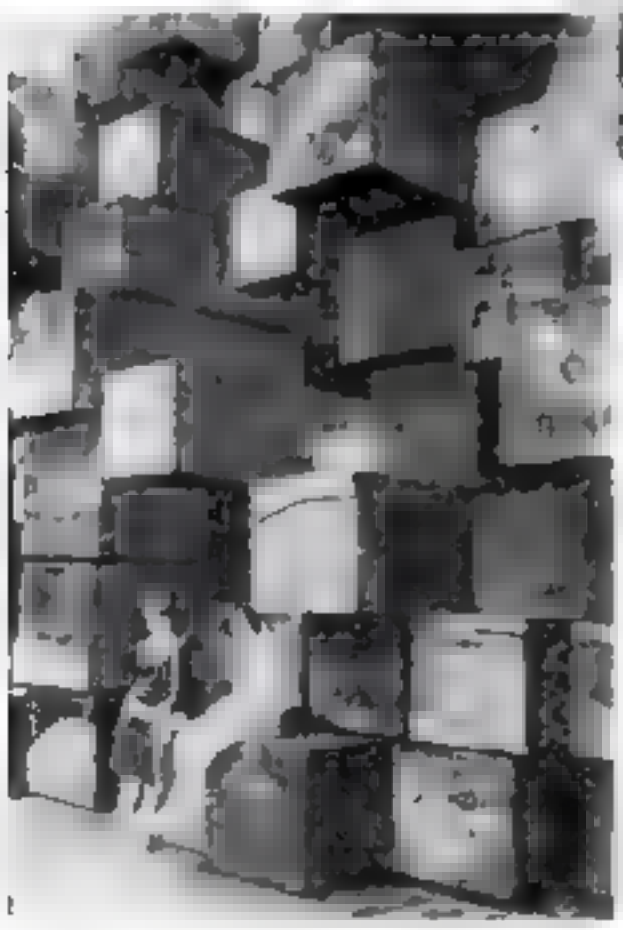
CARRYING more than its own weight, a tiny, rubber-band-propelled model airplane, built by Arthur Horn, of Brookline, Mass., sped down a wooden runway and rose gracefully into the air for a ten-second flight at a recent meet in Boston.

The little plane weighed thirty-four grams. Before the propeller was released for the start, forty-four grams was added. The flight is said to have established a national record for weight lifting by miniature airplanes.

A Mountain of Giant Timbers for China

SOME of the largest timbers ever exported from the forests of the Pacific Northwest were recently piled upon the wharf at Seattle, Wash., for shipment to China. The size of these giant timbers can be appreciated by comparing them, in the picture below, with the two girls of average size, photographed at the base of the mountain of wood.

The bulk of the timbers are of Douglas fir from the great forests of western Washington, and represent one of the chief industries of that state. The largest ones, in cross section, measure two and a half feet square.



Giant Douglas fir timbers ready for shipment. Compare their size with that of the two girls.

Find Saber-Toothed Tiger Had the Toothache

THE sad plight of the giraffe with the sore throat seems to have been equalled by the saber-toothed tiger with a toothache. More than a thousand jaws of this mighty hunter of prehistoric days are being examined at the Los Angeles, Calif., Museum, where they were collected from the tar pits at Rancho la Brea, known as "The Death-Trap of the Ages."

The teeth of these animals, caught in the treacherous pits, along with the Woolly Mammoth and the Giant Sloth of its day, show the presence of many tooth disturbances, such as pyorrhea, dead teeth, and abscesses in the tooth sockets.

The jaws are being examined with the X-ray to discover the condition of the tooth canals. Many of the long front saber teeth that made this animal the terror of its day have dropped from the jaws and others are shown to have been greatly worn, although no tooth cavities have been discovered.

Novel Photo Shows Size of Extinct Giant Bird

FOR the first time a photograph in composite has been produced to show the comparative sizes of a human being and the extinct New Zealand moa—largest bird ever known to have lived. These birds, abundant in New Zealand 400 years ago, vanished, it is thought, because of their cannibalistic trait of eating their own eggs during a shortage of their natural food. Numerous skeletons of moas have been found in various parts of New Zealand, yet no trace of an egg has ever been found. The specimen in the photograph was reconstructed from one of these skeletons.

The extinct bird resembles the ostrich. Built for ground locomotion, it had huge legs, and claws with which it could easily have torn a man to shreds.

Links of Huge Chain Weigh Nearly a Ton Each

THE toppling dome of the famous St. Paul's Cathedral, in London, will be held together by a huge chain of stainless steel which has been constructed especially for the purpose in a Sheffield, England, steel works.

The cathedral built more than two centuries ago by Sir Christopher Wren, was condemned in 1925 as a "dangerous structure" when the dome was found to be gradually tipping toward the southwest. The first plan was to rebuild the upper structure entirely, at a cost of at least $2,500,000. However, by injecting cement into the weakened pillars and encircling the dome with a giant 441-foot steel chain, this expense will be avoided.

The links of the chain, which are shown in the picture above, each weigh nearly a ton and are made up of three and four bars alternating throughout the thirty links. Each bar is nearly fifteen feet long.

New Sound-Absorbing Stone Kills Noise in Rooms

BUILDING stone that absorbs sounds has been found in Florida. The rock is somewhat porous, filled with tiny cavities which soak up sound waves that come to it when used in walls and ceilings of rooms.

Tests by the late Professor Sabine, of Harvard University, showed that extreme noisiness in a room is caused by the reflection of sound back and forth by walls and ceilings. The pores of the new stone prevent this echoing and silence the harsher sounds that come to it.

Popular Science
MONTHLY

SUMNER BLOSSOM, *Editor*
RAYMOND J. BROWN, Managing Editor
ARTHUR WAKELING, Home Workshop Editor
ALFRED P. LANE, Technical Editor
EDGAR C. WHEELER, Associate Editor
ISRAEL DOSKOW, Art Editor

Published Monthly by Popular Science Publishing Company Inc., 250 Fourth Avenue, New York City. Single Copies Twenty-five Cents. In the United States and its Possessions and in Canada, $2.50 the Year. In All Other Countries, $3.00 the Year.

Breaking the Rocks of Knowledge

AT THE Illinois State Museum, Springfield, a curious stone column is being erected. It is formed of blocks from the various strata of the earth's surface, arranged in the order in which they were deposited ages ago. The base is of Altyn limestone from Glacier National Park, estimated to be more than 200,000,000 years old.

These blocks hold the secret of the world's original food supply. Plant life, according to the beliefs of science, preceded animal life because the latter depends upon it. Rocks antedated plants because they are the source of soil upon which vegetation lives.

But the life-giving power in the rocks becomes assimilable only when by a process of erosion it is broken into fragments that plants can use. Similarly, in the realm of knowledge, it is the process of breaking up the great discoveries into forms that the average person can grasp and assimilate that releases their power. Harvey's discovery of blood circulation had little effect while only a few people understood it. Radio, understood by scientists for years, became valuable only when it entered our daily lives.

The fundamental purpose of POPULAR SCIENCE MONTHLY is to break up science into terms that anyone can grasp easily. No discovery and invention can be really powerful until it is understood by all intelligent people.

Always New Wings to Try

A FEW days ago an eminent engineer speaking over the radio, declared that ultimate perfection had been reached in aeronautical engineering. No further change, he said, was likely to occur in the fundamental design of aircraft.

The next morning, newspapers reported that Juan de la Cierva, young Spanish inventor of the autogiro, successfully had crossed the English Channel in his odd windmill plane. As told elsewhere in this issue, this flapping aircraft conforms to none of the accepted rules governing airplane design.

The wise man of the radio seems to be in the class of Thales, who in the sixth century B. C. held that the world is flat and floats on water. He probably knows now, however, that it is unwise to assume that things as they are will never change. There are always revolutionists who will challenge tradition.

True, many of them are wrong, but from iconoclasts who have been right have come the really great advances in science. The simple truth is that there is no such thing as ultimate perfection in scientific achievement, or, for that matter, in any department of human endeavor.

Royal Gifts for All

Dr Marston Taylor Bogart of Columbia University predicts that soon synthetic perfumes will duplicate and replace the costly natural perfumes.

"Synthetic perfumes," he says, "need little labor while the natural process is very expensive. A few vats and stills will do the work of acres of growing plants."

Once again science is revealed as the great leveler. In its gifts to mankind it ignores distinctions of wealth, birth, or class; it considers no special privilege.

With the automobile, it brings distant pleasures to the dooryards of the day-laborer and the millionaire alike. With electricity, it lights the hovel and the mansion at the same time.

Now it is endowing the work-worn shop girl with the delicate fragrance of a queen. There is real democracy in science.

A Just Decision

A LEGAL case, recently decided, may well interest scientists and inventors. The Supreme Court of the United States held that a state could not tax, as income, royalties received by one of her citizens for the use of patents. A patent, it ruled, is a right granted by the Federal Government. Since a state cannot destroy such a right, it cannot tax it because the power to tax, in the words of the famous Chief Justice John Marshall, is the power to destroy. The decision goes a step further and holds that a tax on income derived from the right amounts to a tax on the *right* itself, and therefore cannot be levied by a state.

Rivals to Be Respected

SUPPOSE you were told of a skyscraper four times as high as the tallest building, built without blasting material, blueprints, or steel girders?

Of course, no such building exists. But ants, constructing colony dwellings ten feet high, above and under ground, erect, in proportion to their size, skyscrapers that big.

And Dr. Frank E. Lutz, of the American Museum of Natural History, tells of ant-lions in Colorado that are able, uninstructed, to build conical pits in loose earth, at the bottom of which they wait for unwary ants to slide down into their powerful jaws.

"How," he asks, "can the larva that never saw a trap, never saw its parents, learn to make and work such a contraption to its advantage?"

An interesting problem in heredity and instinct! We can learn much from the insects, tackling giant problems in their miniature world. For, as is pointed out elsewhere this month, they are the greatest enemies of man on earth.

They Are Saying—

"MAN has another billion years ahead of him in which to learn to live at least a million times more wisely than he now lives."—Robert A. Millikan.

"We may have glass pavements for city streets, glass roofs for houses, glass furniture and plumbing."—A. E. Marshall, consulting engineer, Corning Glass Works.

"Life can exist in the interspaces as well as on the planets."—Sir Oliver Lodge.

"The barking of dogs, the clatter of milk cans, the explosions of motors, the noisy parties returning from dances, all late at night, form an increasing menace to the public health."—Dr. John Stevens, English physician.

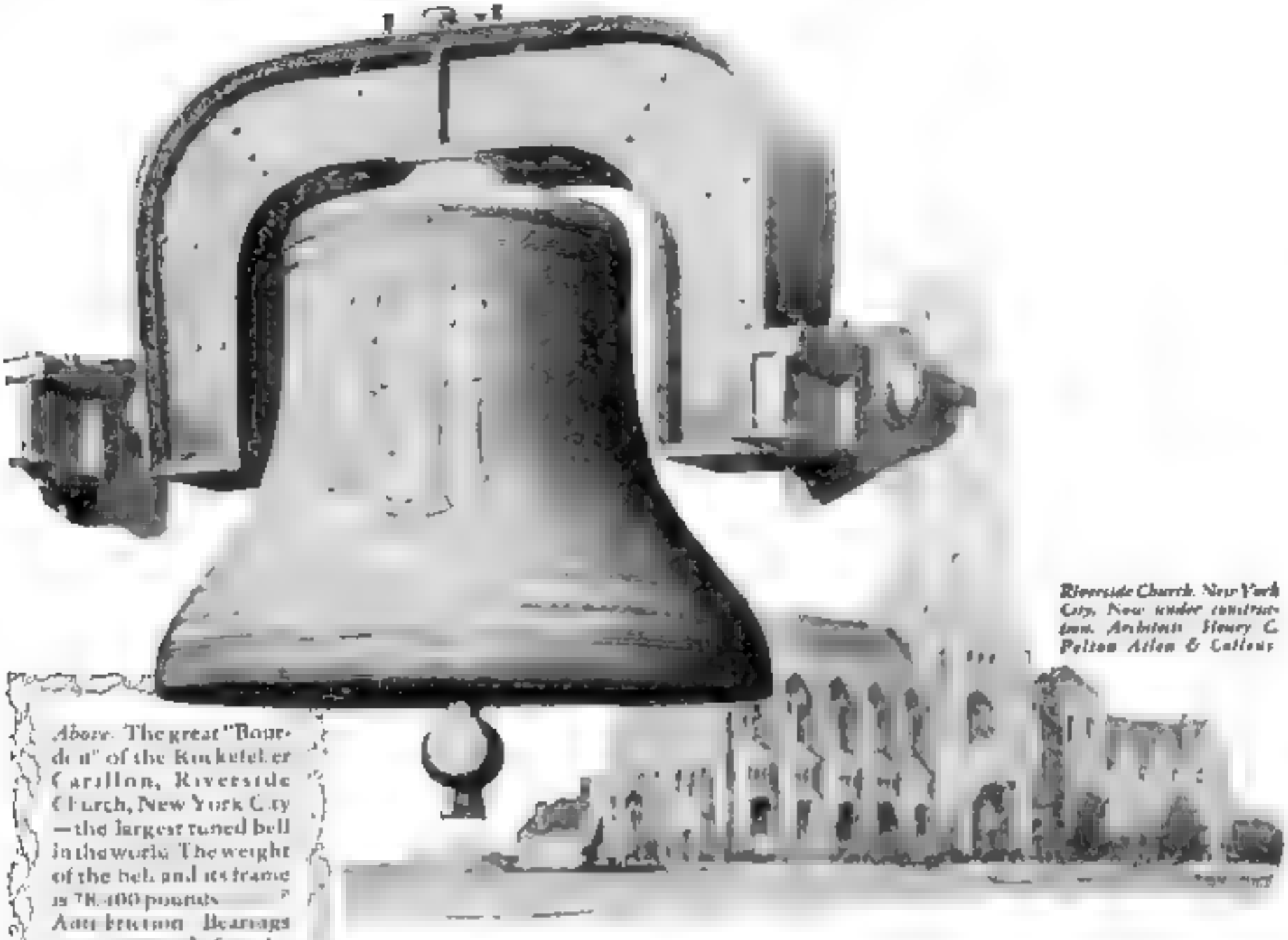
"With an airplane we can map as much territory in one day as we could cover in a month by dog-sled."—Donald B. MacMillan, explorer.

"The loss to automobile owners at the hands of 'gyp' operators of gasoline pumps is $20,000,000 a year."—The American Automobile Association.

"Walking will be easier for nearly everyone in the United States, within a year, as a result of the recent discovery of a method of measuring the pliability of leather."—John A. Wilson, president, The American Leather Chemists' Association.

"If flying becomes as common as motoring, man's physique will undergo drastic alteration, eyes and ears being affected first."—Lt. Col. Levy M. Hathaway, Chief Flight Surgeon, U. S. A.

"By mating the more energetic varieties we may produce busier bees."—Dr. Lloyd R. Watson, Cornell University.



Riverside Church, New York City, Now under construction. Architects: Henry C. Pelton Allen & Collens

Above. The great "Bourdon" of the Rockefeller Carillon, Riverside Church, New York City—the largest tuned bell in the world. The weight of the bell and its frame is 78,400 pounds. Anti-friction Bearings were selected for the main journals and for the clapper and counter-weight which in themselves weigh about one and one half tons.

The "Bourdon" is one of seven new bells that, when added to the fifty-three bells now in the Carillon, will make the Rockefeller Carillon the largest in the world.

Helping the vibrant tongues of the largest tuned bells in the world sing out their Christmas songs

SINGING a song of industry all through the year—speeding giant trains along their way—helping great dredges delve into river bottoms—whirling *all* mechanical things along toward greater achievement...And then at Christmas-tide, when the spirit of the Day envelopes the world and glad tidings speed through the land, the same anti-friction bearings help swing the giant bells that send their sonorous voices out over a great city singing, "Merry Christmas".

SKF INDUSTRIES, Inc., 40 East 34th Street, New York City

Nothing is apt to cost so much as a bearing that cost so little.

SKF

THE HIGHEST PRICED BEAR'NG IN THE WORLD

© SKF Industries, Inc. 1928

Can *Your* Car Stand the Cold?

Timothy, a Timid Soul, Thought His Couldn't, Until Gus Told Him a Few Easy Ways to Make It Winter-Proof

By MARTIN BUNN

"You're dead right about winter being hard on cars in general," said Gus, "but that's no reason it should be hard on your car if you give it proper attention."

A CHILL wind whistled an accompaniment to the squeal of the brakes on Gus Wilson's machine, as the veteran auto mechanic stopped his car in front of the Model Garage and tooted his horn. The doors swung open and a mingled odor of burning kindling wood and hot steam pipes greeted his nostrils as he drove in.

"You beat me to it," he called to his partner, Joe Clark, as the latter closed the doors behind him. "I was going to suggest that we'd better start the furnace. A bit of heat feels good on a day like this.

"Howdy, Mr. Timothy," he added as he caught sight of a thin, neat little man whose physical insignificance was in startling contrast to the huge sedan he owned. "You're the first customer this morning. What can we do for you?"

"Well, er—" the mild little fellow hesitated, "I was just remarking to Mr. Clark, here, that I'm afraid it's about time to put my car away for the winter and I wanted to ask you if there are any special precautions I should take."

"Why put it away?" questioned Gus bluntly.

"Oh! I couldn't think of keeping it in commission all winter," said Timothy, apparently quite horrified. "Everybody tells me winter weather is extremely hard on a car, and you know I take a lot of pride in that machine. I'd hate to have anything happen to it." He stroked the broad, shiny mud guard like an old maid fondling her pet cat.

"You're dead right about winter weather being hard on cars in general," Gus agreed, "but that's no reason why it should be hard on *your* car if you treat it like it ought to be treated. The extra wear winter takes out of a car can be blamed on the owner's ignorance or carelessness ninety-nine times out of a hundred and the hundredth case is due to conditions you'll never encounter.

TIMOTHY brightened perceptibly. "If that's really true, Mr. Wilson," he said, "I'm exceedingly glad to know it. I rather disliked the idea of doing without my car all winter. It's the only amusement I have."

"Don't you worry about its being true," Gus asserted. "You just pay attention to what I tell you and I'll guarantee that at the end of the winter your car won't show any more wear than it would after the same number of miles of summer driving. You'd better get out a pencil and a notebook, so you won't forget.

"All ready?" said Gus. "The first thing, then, is to find out what parts of the car can be put on the blink by cold weather, then we can figure out how to stop it. Cold weather raises hob with the cooling system, for one thing. Cooling systems are designed to keep the motor temperature well below the boiling point of water, even in the hottest summer weather when the air that shoots through the radiator gets up to eighty degrees, or even more.

"THE air in winter may be fifty, or even eighty, degrees colder, and it soaks the heat out of the radiator so fast that the motor never gets a chance to warm up the way it ought to. Cold oil doesn't flow as it should and that means the motor doesn't get the proper lubrication. Cold gasoline doesn't vaporize and you literally keep spraying the cold cylinder walls with raw gasoline. If you keep a motor running that way the rings, pistons, and cylinder walls wear to beat the band."

"But my car has a thermostat control to prevent the water from circulating if it is too cold," objected Timothy.

"That kind of a thermostat helps a lot," Gus agreed, "but it has one disadvantage in very cold weather. It slows down the water circulation so much that the water flowing into the bottom of the cylinder jacket is cold and the cylinder walls are kept cold enough to condense quite a lot of gasoline. However, it's easy enough to fix that by covering part of the bottom of the radiator so the water will have to circulate faster. The main point is to see that the motor operates just as warm in winter as it does in summer."

"In other words," Timothy interrupted, "I should watch the thermometer on the radiator cap and see that after the motor warms the running temperature is the same as in summer."

"That's the idea," said Gus, "but you can't do it with that radiator thermometer. It doesn't read within a mile of right in winter, especially if the water level in the radiator is a bit low. You've got to have one that reads directly from the water in the cylinder jacket or the outlet hose. I can fit one of that kind."

"What proportion of alcohol and water do I have to use in the radiator?" Timothy inquired.

"You won't use any if you take my advice," Gus growled. "Alcohol really has nothing to recommend it. Of course it will keep the radiator from freezing, but you either have to run the motor too cold for best efficiency or else keep putting in more alcohol every few days to make up for the alcohol that boils away."

"SPEAKING of boiling away the alcohol," Joe interrupted, "reminds me of the time I nearly got punched as a rum runner by a green prohibition agent. It was one of those mild spells we have every so often in winter and I'd been hitting the high spots till the motor was good and hot. I was leaving a trail of alcohol fumes strong enough to poison a dog, and this dumb-bell officer whiffs it and takes after me, thinking I had some cases of liquor and one of

(Continued on page 141)

A Radiotron for every purpose

RADIOTRON UX-281-A
Detector Amplifier

RADIOTRON UV-199
Detector Amplifier

RADIOTRON UX-199
Detector Amplifier

RADIOTRON WD-11
Detector Amplifier

RADIOTRON WX-12
Detector Amplifier

RADIOTRON UX-200-A
Detector Only

RADIOTRON UX-120
Power Amplifier and Audio Stage Only

RADIOTRON UX-222
Screen-Grid Radio Frequency Amplifier

RADIOTRON UX-112-A
Power Amplifier

RADIOTRON UX-171-A
Power Amplifier and Audio Stage Only

RADIOTRON UX-210
Power Amplifier Combined

RADIOTRON UX-240
Detector Amplifier for Resistance coupled Amplification

RADIOTRON UX-250
Power Amplifier

RADIOTRON UX-226
A.C. Filament

RADIOTRON UY-227
A.C. Heater

RADIOTRON UX-280
Full-Wave Rectifier

RADIOTRON UX-281
Half-Wave Rectifier

RADIOTRON UX-874
Voltage Regulator Tube

RADIOTRON UV-876
Ballast Tube

RADIOTRON UV-886
Ballast Tube

The standard by which other vacuum tubes are rated

RCA

Look for this mark on every Radiotron

"Made by the makers of the Radiola," RCA Radiotrons are the vacuum tubes used by many leading manufacturers to equip radio instruments of the finest performance. The RCA mark on the tubes of a receiving set or a dynamic speaker is the first test of the dependability of the product.

To maintain high quality performance in your radio set, replace all the vacuum tubes with a new set of RCA Radiotrons at least once a year. Do not put new tubes with old ones that have been long in use.

RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA

RADIO CORPORATION OF AMERICA · NEW YORK · CHICAGO SAN FRANCISCO

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Handy Kinks for Car Owners

A Convenient Place for the Road Map -How to Stop Tire Rim Creaks -Other Ingenious Ideas You May Find Useful

NOWADAYS nearly every car is built with the top so low that every time you go over a severe bump, your hat brushes against the ceiling. This results in soiled spots, unless special precautions are taken. The simplest of these is shown in Fig. 1. Pin a piece of cloth, matching the top material as closely as possible, at the point where your hat strikes. When soiled it can be removed and washed.

A Ground for the Timer

ONE of the most baffling ignition troubles is a poor ground on the timer housing, caused by the loosening of the bearing between the breaker cam shaft and the housing. A varying resistance

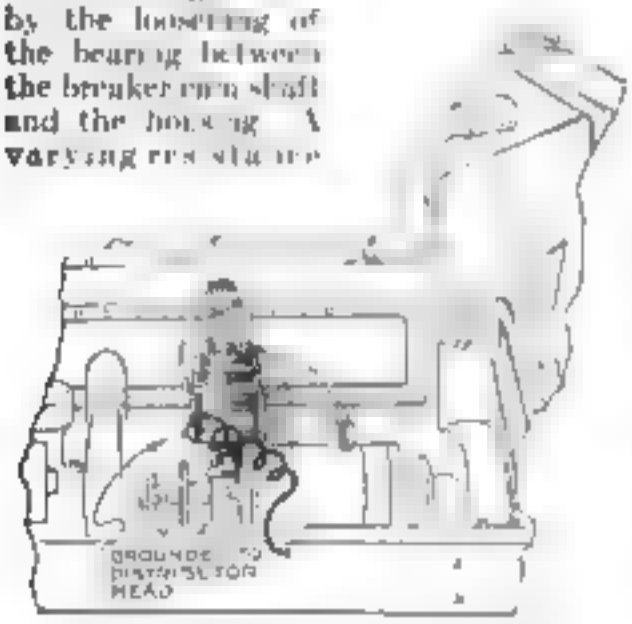


Fig. 2. Effective ground for timer housing.

thus is introduced into the path of the current.

You can eliminate trouble from this source by the method shown in Fig. 2. Fasten one end of a piece of stranded insulated wire under any convenient screw on the metal part of the timer housing. Connect the other end to any screw on the nearest fixed metal part, such as the frame of the car. This wire will provide the necessary path for the current.

To Stop Rim Creaks

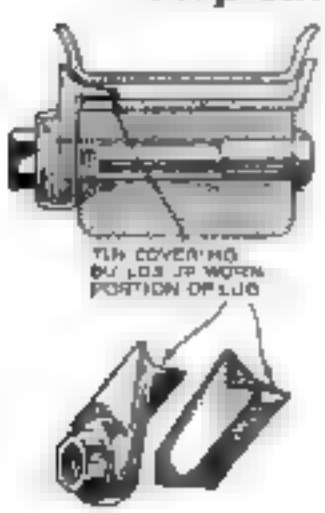


Fig. 3. Sheet tin covering restores worn lugs.

WHEN the lugs wear so much that they no longer can be clamped solidly against the rim, a disagreeable creaking noise is produced. You can remedy the trouble by oversize lugs or by fitting a piece of sheet tin over each lug, as shown in Fig. 3, at the left.

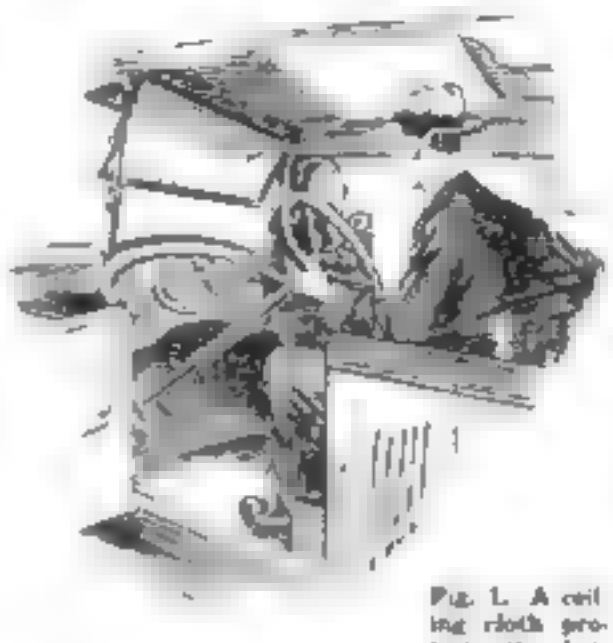


Fig. 1. A ceiling cloth protects the hat.

Novel Place for Licenses

AUTO owners' and drivers' licenses often become misplaced, and then you are out of luck when a traffic cop demands that you produce them. However, if there are pull curtains at the windows of your closed car, you have an

Fig. 3. Rolled in a curtain for safe keeping.

excellent place to keep them. Pull the curtain down, tuck them in the roll, as shown in Fig. 3, then let the curtain roll up again. They will remain where you can always find them. After being in the curtain a while the cards will become set to the rolled form and when the curtain is lowered will curl about the roller instead of dangling.

A Handy Curtain Road Map

ORDINARILY, when you want to consult a road map, you have to unfold a large and hard-to-handle sheet of paper. A convenient way to carry the map is to fit a roller curtain just above your windshield so that it can be pulled down, as shown in Fig. 4. Glue or otherwise fasten the map to this curtain. The

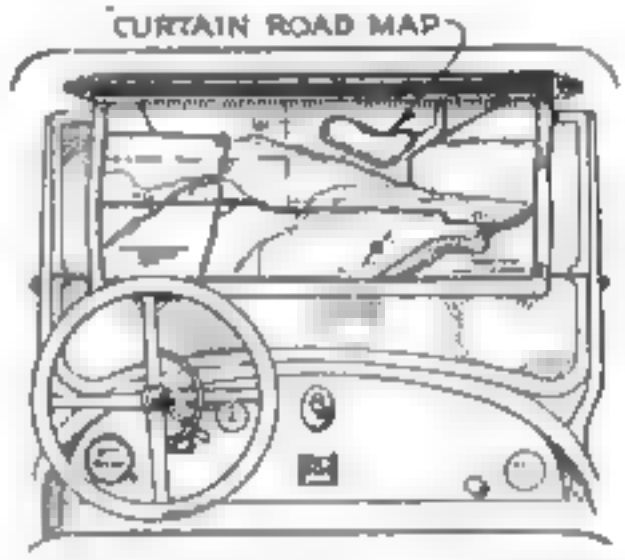


Fig. 4. Glued on a curtain above windshield.

map will cover the windshield and make driving impossible, but you would have to stop the car to study a map anyway.

A Useful Electromagnet

THERE are many times, in auto repair work, when electricity can be made to save a lot of work. For instance, if a steel ball that operates as a check valve in the oil line is in such a position that it will not roll out by gravity, you may have to turn the part upside down to let it roll out.

A homemade electromagnet, shown in Fig. 6, will do the trick. All you need is a small quantity of bell wire and an iron rod small enough to go in the hole. Wind a coil of the wire around one end of the rod, attach the ends to a storage battery, and you will find that the other end of the rod will act in the same way as an electromagnet and pick up any small steel or iron object.

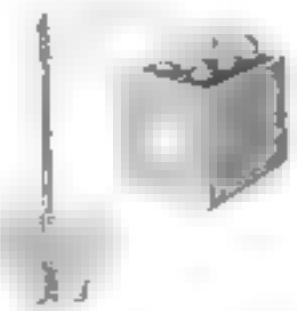


Fig. 6. A simple magnet works from battery.

Ten Dollars for an Idea!

P. D. Vollwock, of Edwardsport, Ind., wins this month a $10 prize for his suggestion of a curtain road map (Fig. 4). Each month POPULAR SCIENCE MONTHLY awards $10, in addition to regular space rates, for the best idea sent in for money. Other contributions used are paid for at the usual rates.

Red STANDARD—Suits most writers. A splendid correspondence point. Medium flexibility. For home and general use.

Green RIGID—Tempered to armor plate hardness. Will not shade even under heavy pressure. Unequaled for manifolding. The salesman's friend.

Purple STIFF FINE—Writes without pressure. Makes a thin, clear line and small figures with unerring accuracy. Popular with accountants.

Pink FLEXIBLE FINE—As resilient as a watch-spring. Fine, tapered point; ground fine to shade at any angle. Loved by stenographers.

Blue BLUNT—An improved stub point. This point makes a broad line. May be held in any position. Liked by rapid writers.

Yellow ROUNDED—A different pen point. The tip is ball shape. Makes a heavy, characteristic line without pressure. Suits left handed writers.

The Color Band Inlay on the Cap Identifies the Character of Every Pen Point

Waterman's Number 7

The popular way today is to pick your pen point by color. Thousands by this simple method are now enjoying real writing comfort for the first time. Quickly and accurately, from six different styles, you select the pen point best suited to your way of writing. The perfectly balanced No. 7 stainless holder of Ripple Rubber, fitted with a personally selected point, assures permanent fountain pen satisfaction. Without further delay ask the nearest merchant to show you all six styles of No. 7.

Number Seven Desk Sets

The same accurate method for securing perfect pen point performance is now available in Waterman's new movable Gyro-Sheath Desk Sets. By far the most practical desk ornaments ever offered. Of onyx and marble in modernized classical outlines, they are creations of rare beauty. And the Special No. 7 pens, with color band inlay on artistic tapering holders of Ripple-Blugreen, Ripple-Olive and Ripple-Rose, complete a variety of ensembles of exceptional charm. Ideal for office or home use, or, as gifts of distinction.

L. E. Waterman Company, 191 Broadway, New York
Chicago Boston San Francisco Montreal

$7.00

Number Seven

Six styles of pen point. Graduated from fine to blunt.

Desk Set No. 7187—Onyx base, green gold finished frame and name plate 3 x 4 ½, price $18.00

Desk Set No. 6467—Black and gold marble oval base, 7 x 10, two pens, price $30.00

Desk Set No. 8067—Onyx base, 2¼ x 2¼, price $10.00

Desk pens may be had in all color holders and all styles of nibs

Waterman's

Your boy is safe when he is working with tools and wood

Set No. 904, 12 tools—oak cabinet. Price $15.

Set No. 907, 7 tools in cardboard box. Price 55. This set includes plans for making a tool cabinet.

Set No. 902, 20 tools—oak cabinet. Price $25.

Fun for him—plus something more—this working with tools and wood.

A chest of tools will keep your boy's mind occupied profitably. Your boy's spare time deserves your thought—your guiding influence.

And—did you ever stop to think—how few toys make *lasting* gifts? Tools, with Stanley Plans to get him started right, will keep him interested all year 'round—and many years to come.

There are 25 Stanley Plans: boats, doghouses, tables, chests, work benches, etc. They sell for 10c each at your hardware dealer's. There is, also, our new book "How to Work with Tools and Wood". Your hardware dealer has this, too. You can get it for $1.

On the left are three typical Stanley Tool Chests. There are 16 altogether, ranging in price from $5 to $95. Ask your hardware dealer for catalog showing them all. Or write to us for a free copy of Catalog No. Se35. The Stanley Works, Advertising Department, New Britain, Connecticut.

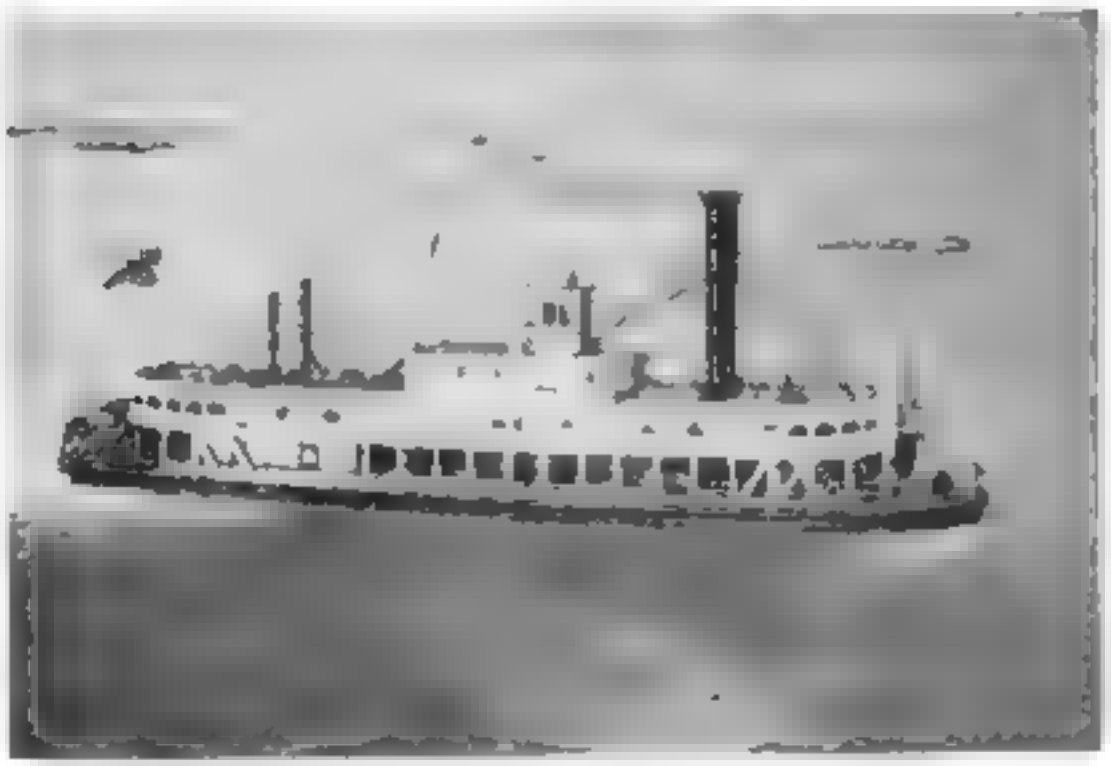
STANLEY TOOL CHESTS

The all-year-'round Xmas gift

River Romance Returns with Packet Models

How to Build a Stern-Wheel Mississippi Steamboat

By E. ARMITAGE McCANN, *Master Mariner*



By following our new series of ship model articles, of which this is the second, you can build a model of the *Buckeye State* as realistic as the model shown at the left.

YOUR Mississippi steamboat model should have its main deck laid by this time, if you followed the suggestions given in the last issue.

Those who missed that article, which was the first in our new ship model series, can easily make up for lost time, if they wish to build this unusually decorative, romantic, and original little boat, by sending for POPULAR SCIENCE MONTHLY Blueprints Nos. 94, 95 and 96 (see page 108). These sheets contain complete full size drawings of the boat and its various parts.

We must not forget, while building our stern-wheel river packet, that it represents what has been called America's most typical boat. It is a real native, like the American Indian canoe.

Clyde Fitch described it in his characteristic style when he wrote:

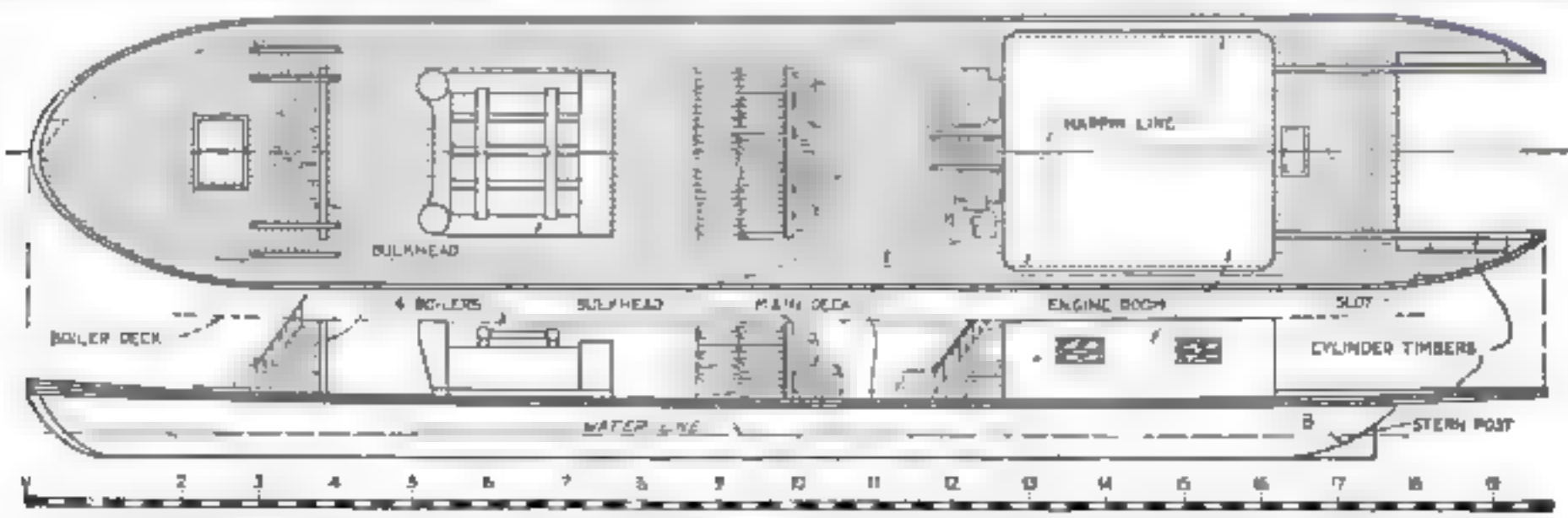
"The steamboat is from 100 to 300 feet long and from 30 to 50 feet wide. It is from 40 to 70 feet high above water, but it does not extend more than three feet into the water. That is because that is all the water there is. A steamboat must be so built that when the river is low and the sand bars come out for air, the first mate can take a keg of beer and run the boat four miles on the suds. Steamboats were once the beasts of burden for the great Middle West and a city which could not be reached at low water by a steamboat with two large hot stacks, twenty-five negro roustabouts on the bow end and a gambler in the cabin, withered away and died in infancy. But the railroad, which runs in high water or low and does not stab itself in a vital spot with a snag, came along and cleared the steamboat out of business. There are only a few left now, which is a great pity, for the most decorative part of a great river is a tall white steamboat with a chime whistle and a flashing wheel in the far foreground."

This type of boat, however, has not vanished by any means. Most of those now in use are entirely up-to-date for their purpose. They have steel hulls, steam machinery to handle cargo and gangways, electric lights, and everything of the latest design.

There are not many of the boats still "running passengers," but there are show boats, excursion boats, and an ever increasing number of freight boats. Moreover, this type of boat is built and shipped to many parts of the world where similar river conditions obtain.

On the main deck nearly everything necessary must be placed before the next deck (the boiler deck) is laid.

The engines we have inclosed in an engine room because it is hardly worth the trouble of making dummy engines to show, and this block makes a good support for the next deck. This engine room is just a block of any wood 1⅛ in. high by 3⅛ in. wide and 3½ in. long. It will be painted white and can have two windows painted in either side, and double doors in the middle, abaft. Cuts are sawed on either side up from the bottom about ⅜ in., so as to come exactly outside the cylinder timbers, previously described. The ends of the pitmen work in these slots. The block is butted up to the *(Continued on page 108)*



View looking down on the main deck of the model and a side elevation, both showing just what parts are put in place before the second, or boiler, deck is added. These and all other essential views appear full size on the blueprints. Compare them with the photo on page 108.

"Tell Me *What* to Turn,"

Says the Man with a Lathe—So Here Are Six Designs Suitable for Gifts

By William W. Klenke
Author of *Art and Education in Wood-Turning*

Wood turning is rapidly becoming one of the most popular home shop hobbies

PORTABLE motorized home workshop outfits are now available that give the amateur woodworker the use of a lathe and other machines. These have aroused new enthusiasm for the old-time and most fascinating art of wood turning.

With the help of articles on the use of a lathe such as are published from time to time in POPULAR SCIENCE MONTHLY and with the aid of a textbook or two, anyone can easily master wood-turning at home and then make beautiful, useful articles from scrap or waste material.

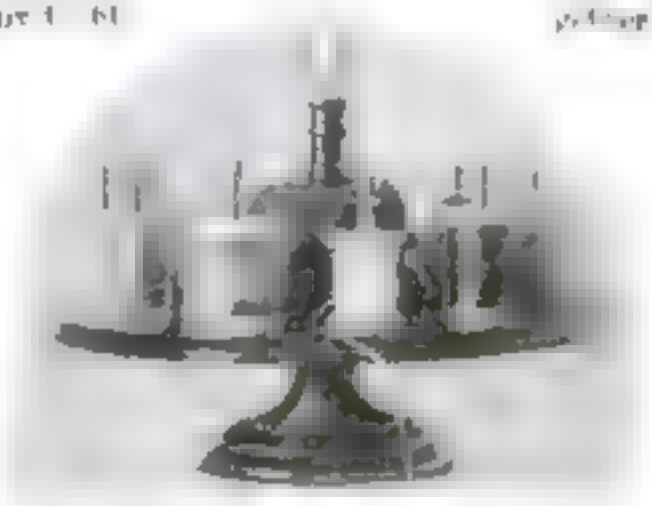
"But what shall I make?" or "What shall I turn next?" is the question that the beginner soon asks. A variety of attractive objects are suggested in the accompanying illustrations. They were selected because of their suitability as Christmas gifts and because they are small and relatively simple. In making them, the following outline of the processes will be of assistance to the inexperienced wood-turner:

Flower holder. Step I—Base: Stock 1½ in. thick and 3½ in. in diameter. Turn on a screw chuck. Work the bottom side to correct form. Rechuck and turn face. Step II—Shaft: Bore hole for test tube, plug hole and turn around this hole. Fit the shaft dowel into the base. Step III: Stain and polish in the lathe.

Teapot stands. Step I—Turn the bottom to shape and rechuck. This operation may be omitted, if desired, to simplify the turning. Step II: Turn the face side, Step III: Stain and polish in the lathe. Step IV: Fasten an etched copper or German silver top to the stand.

Picture frame moldings. Step I: Turn the face side or molding design. Step II: Stain and polish in the lathe. Step III—Rechuck and turn the rebate for the picture and glass. Five designs are given below.

Lady's sewing set. Look around the house for a small ink bottle about the size indicated on the drawing. Step I: Box part: Turn out the inside of the box to fit the bottle. Step II—Rechuck and turn the outside. Step III: Cover: Turn the inside of the cover to fit over the neck of the bottle. Step IV—Rechuck and turn the outside of the cover to design. Stain and polish in the lathe. Step V—Make the base and screw into the box part from the bottom. Glue felt to bottom.



As a gift for any woman, what could be more appropriate than this graceful sewing set?

Boudoir watch case. Purchase the watch first, a cheap one with radiolite face will be satisfactory. Step I: Turn the face portion first, rechucking and turning the back to fit the watch. Step II—Turn the back portion, fitting it to the face portion.

Sewing set. Step I—Base: Turn the bottom side. Rechuck and turn the face side to design. Step II—Turn the disk on both sides. Step III—Turn the cushion holder. Step IV: Turn the shaft between centers. Step V—When gluing the parts together do not fasten the disk, it should be free to revolve. Cement the brass dowels in place.

For the beginner, a few general hints may be helpful. Before starting the lathe, see that all adjustments are fastened. Start all work on slow speed. Long, slender work that has been rechucked and large, heavy pieces must always be turned slowly. Do not remove the work from the lathe without marking the center and the end of the wood so that both may be returned to the same piece at a future time. This keeps your work on center.

Never feel the article you are turning while it is spinning around or you may be injured. Stain must not be applied while the wood is revolving, because of the centrifugal force.

Mr. Klenke's long experience in wood turning guarantees the practicability of these designs. The dimensions have proved satisfactory but they can be modified by the individual worker

For detailed instructions on how to perform the fundamental wood-turning operations, see the series of articles on wood-turning by Herman Hjorth which appeared in the March, May, June, July, August, September and October, 1928, issues.

Whatever you need in a blow-torch you'll find in the Clayton & Lambert line

PERHAPS you use a blow-torch only once in a while. In that case you don't need a torch built for hard use on every kind of a job, every day and all day. And you don't need to pay the higher price, either. Not when you can buy the new Clayton & Lambert 158.

It's a low-priced blow-torch—just what you want—but we don't know where you can buy a better blow-torch at any price, outside of the Clayton & Lambert line. It's husky, with a strong, thick base that protects the tank. Everything in it is made to exacting precision standards, so that it works right—and keeps on working right as long as it is not abused. It holds its compression. And it gives you a hot flame in a jiffy.

On the other hand, if you do use a blow-torch in your daily work, we believe you'll find the Clayton & Lambert 32 better suited to your needs. For in addition to the excellent qualities of the 158, it has the new, patented, Clayton & Lambert gas orifice. That orifice is made to the exact size for perfect operation. And it cannot be spread and enlarged by the needle-valve. Nor can it clog; every time you turn the torch off, the needle-valve cleans the orifice.

There are other refinements, too, which make a difference in performance and length of life. The difference is so notable that blow-torch users have made the Clayton & Lambert line the most popular in the world.

Hardware, electrical and supply houses sell these Clayton & Lambert blow-torches—or if they don't have them in stock will get them for you quickly. You can tell them quickly because they've got *red handles*.

CLAYTON & LAMBERT MANUFACTURING CO.
DETROIT, MICHIGAN

C & L 158

This blow-torch is especially made and priced for the man who likes to do odd jobs around the house, or to tinker with mechanical things. It will last a lifetime if it is not abused. The usual retail price is about five dollars. Most hardware, electrical and automobile accessory stores have it—or can get it for you quickly.
Look for the red handle.

C & L 32

This is one of the most popular blow-torches we have ever made. It is more expensive than the 158 because it is made for much harder use. It is designed for the man who uses a blow-torch in his daily business and demands not only excellent performance but rugged ability to stand rough handling. 32 contains the most advanced, patented C & L blow-torch improvements. It also has a red handle

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Clamps for Speedy Work

How to Make and Use Them for Fastening Parts to Lathe Faceplates and to Machine-Tool Tables

By HENRY SIMON

Correct methods of holding and clamping work save much time in the long run.

LARGELY, no doubt, because of the many "high-brow" production problems which constantly call for attention, some of the everyday shop tasks, such as holding and clamping work on machines, are not receiving the care that they deserve. And since these small details enter into our daily work at every turn, we pay for this neglect by a running tax in the shape of trouble, holdups, loss of time, annoyance, and spoiled work.

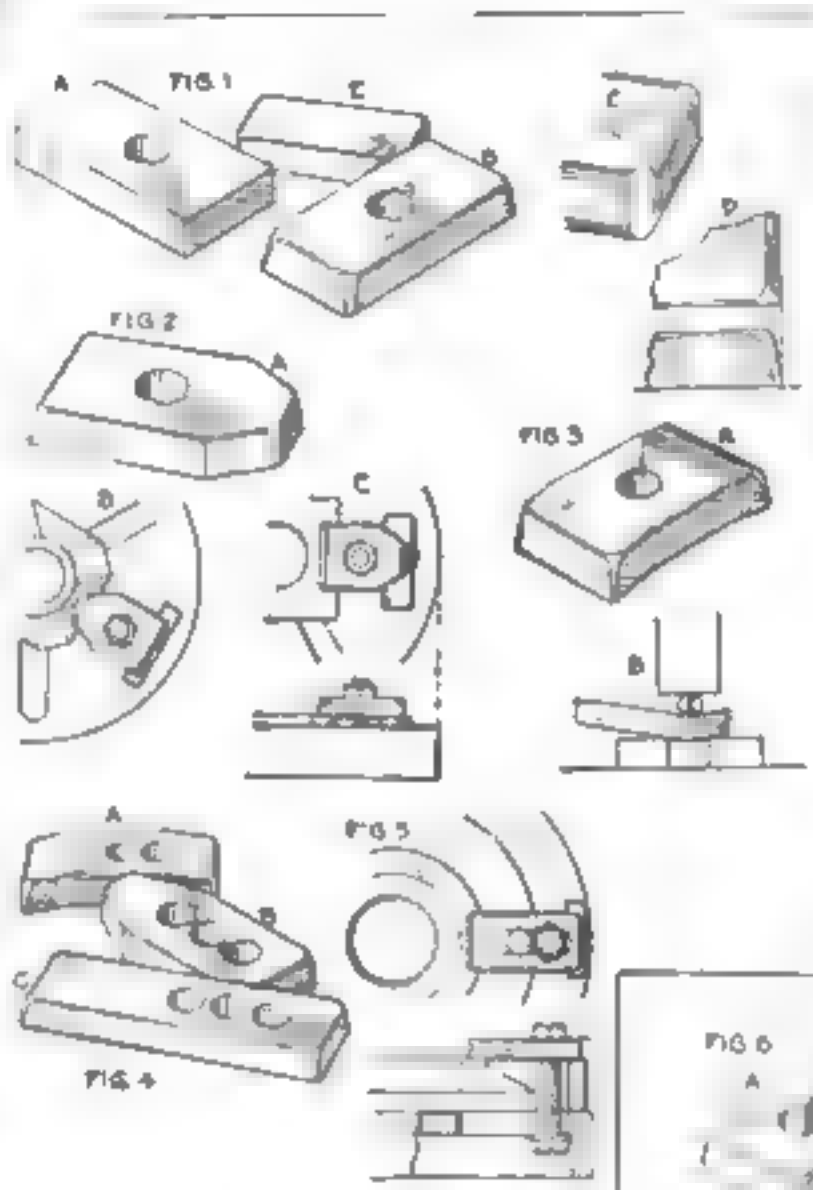
It is the purpose of the present article and several following articles to deal with some of these ever-recurring problems and to point out how, with a little forethought and some spare-moment time, we can effect improvements in our practice of holding work that will sum up to an astonishing total, in the end.

Since holding work on machines is to a large extent a matter of clamps, let us start by giving that box of miscellaneous clamping equipment under the workbench the "once-over." There are, no doubt, many shapes and sizes in there, which is exactly as it should be. Some among these clamps probably are standard products of some machine-tool equipment manufacturer. But the greater number, perhaps, are homemade, and most of these are very likely plain straps made from different sizes and shapes of cold-rolled steel.

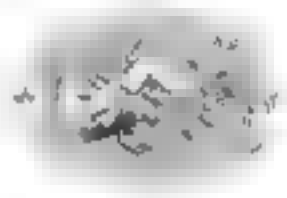
A homemade strap should resemble the manufactured product in at least one thing—the absence of all sharp edges and corners, especially on the "air" side. Are yours that way? Or do you remember cutting and bruising yourself, not once but repeatedly, on a corner such as those at *A* in Fig. 1, because it seemed too much trouble to remove them at the time you sawed the piece off the bar, while the work was waiting for you to go ahead? It will pay to go over all the strap clamps in spare moments, and round the corners and edges as at *B*.

To round them is easy enough, although a little forethought should be used. Do not round the edges heavily on both faces all over as at *C*, because this detracts from the ability of the strap to take hold. It will be fine to have them that way on the upper side, though it suffices to bevel or round the edges only enough to make the clamp comfortable to handle.

The lower edges—at least those of the ends—should only be well



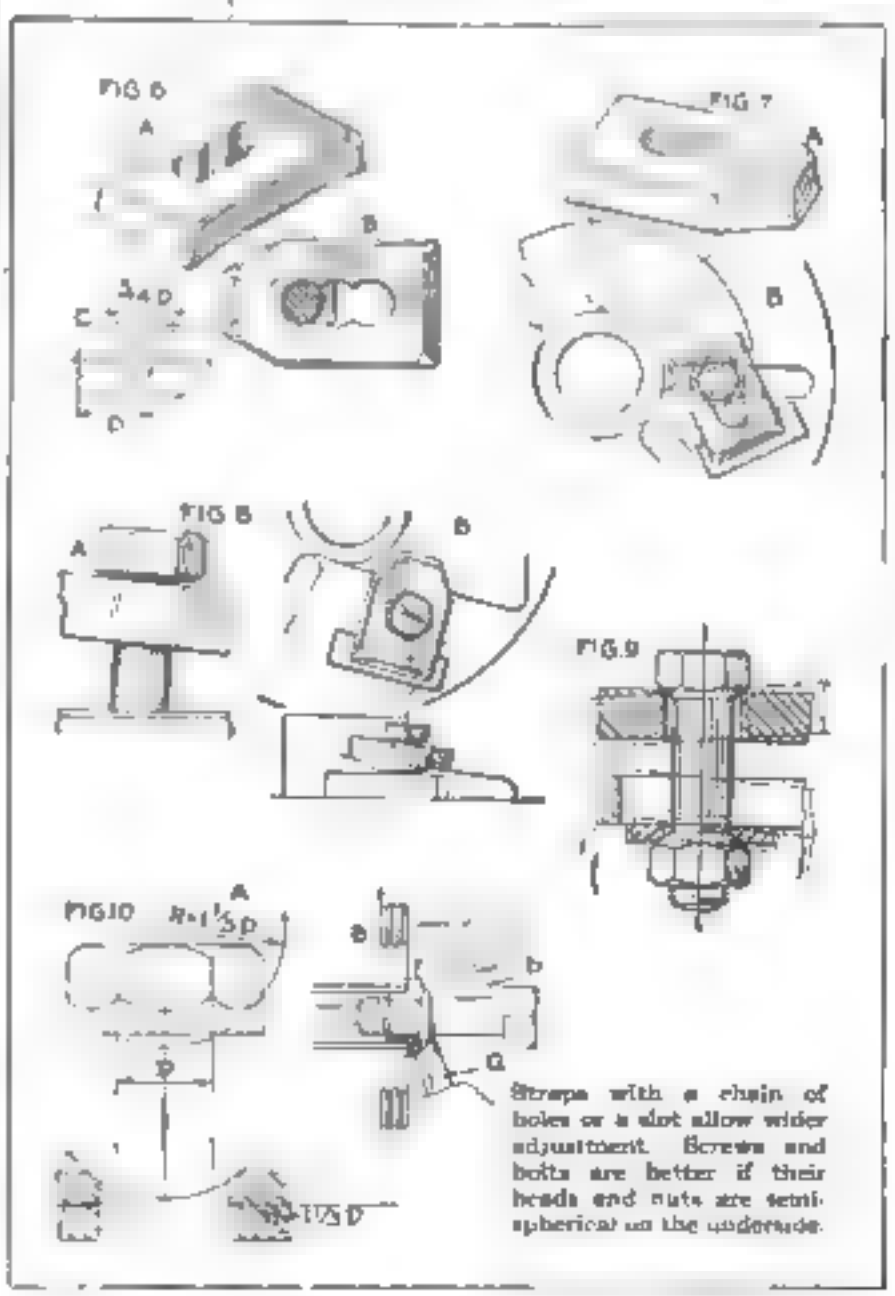
Even such a simple thing as a clamp strap can be made in some ways better than others.



"broken," because it is sometimes necessary to take hold of a part by a close margin. A good and quick way is that shown in detail at *D*, which gives practically every advantage without decreasing the efficiency of the clamp. Note that the end faces are slightly beveled back for better clearance on shouldered work. The edges also should be at least broken and the corners knocked off any blocking used under the straps, as at *E*.

There will always be cases where clamps with specially formed ends must be used. If a good supply of different shapes and sizes are on hand, the need for such special parts can be largely avoided.

A good way to render strap clamps more versatile is to make one end with a blunt point, as at *A*, (continued on page 86)



Straps with a chain of holes or a slot allow wider adjustment. Screws and bolts are better if their heads and nuts are semi-spherical on the underside.

The 100-inch Hooker Telescope at Mt. Wilson Observatory which has increased the known universe by half a billion stars. The movable parts weigh 100 tons but can be regulated down to a minute fraction of an inch.

The telescope is a symbol of supreme accuracy. It in turn is dependent upon a perfection of mechanical workmanship in which Starrett Tools play a vital part.

Wherever ACCURACY counts you'll find Starretts

Search for the underlying causes of the breath-taking mechanical achievements that have spurted human progress over the past three decades and you'll find principal among them the development of the art of precision workmanship on a grand scale.

The L. S. Starrett Company takes sincere and honest pride in the fact that it has given to industry and engineering the tools without which such progress would have been materially impeded.

Tool dealers everywhere are glad to sell you genuine Starrett Tools.

There are over 2500 Starrett Tools, some of which you need to do better work more easily and with greater satisfaction. Your tool dealer has them. Ask him and write us to send you a free copy of the complete Starrett Catalog No. 21"S."

THE L. S. STARRETT CO.

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS., U. S. A.

Use Starrett Tools

2258

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

How to Make Clamps for Speedy Work

(Continued from page 84)

Fig. 2. Made in this way, the strap can be used either as at *B*, where projections on the work require a narrower point, or with the broad end for holding as at *C*, where it is desired to obtain a wide bearing in order to hold down thin work. It will, in fact, pay to shape most flat clamps that way.

Bought clamps invariably have low "feet" at the ends to insure obtaining a purchase with the ends only. A similar effect can be easily produced in a flat steel strap by kinking it under a screw press as shown in Fig. 3 at *A* and *B*. Strap clamps so treated are less trouble to adjust than a flat clamp, which must be blocked up very nearly level to hold well.

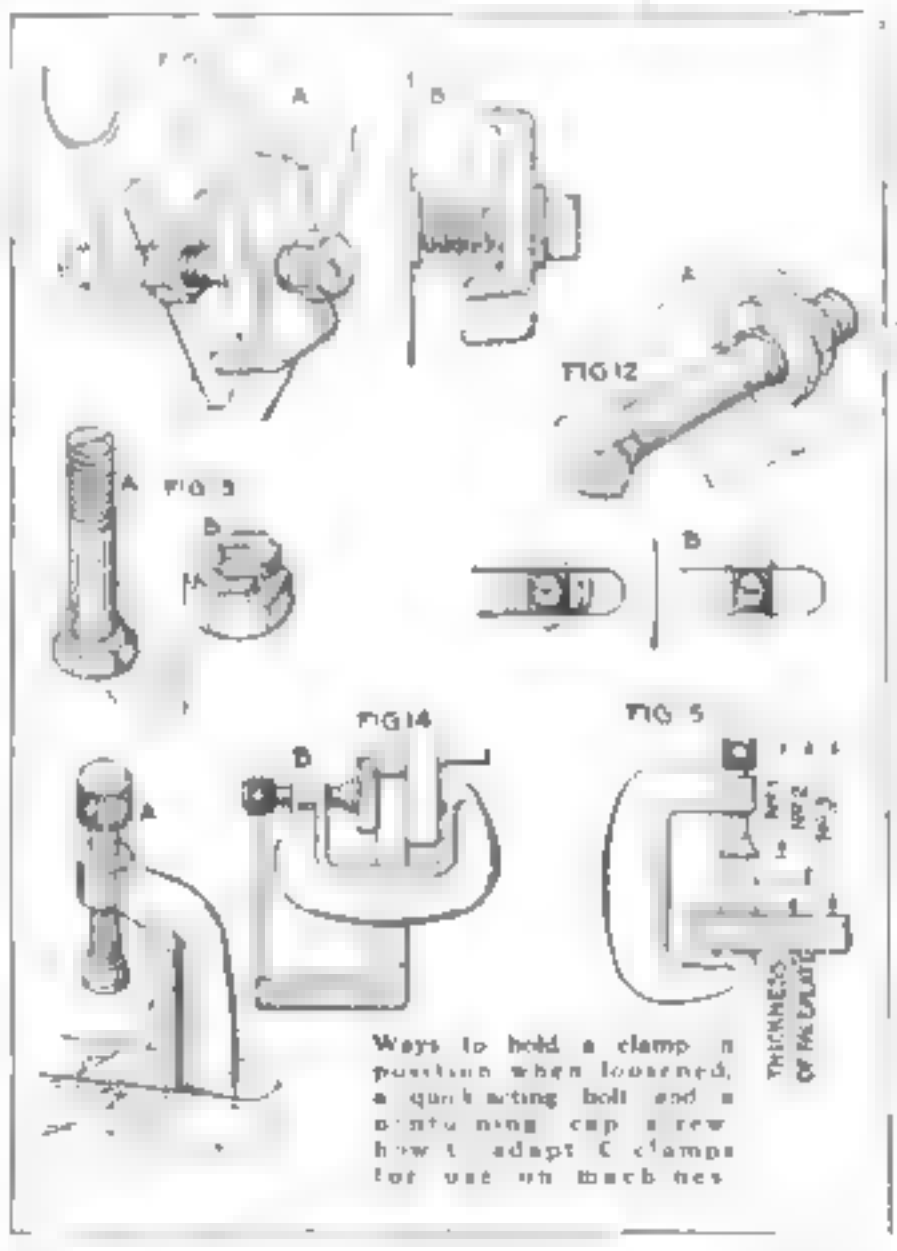
Strap clamps, whether bought or home made, usually have only one round hole for the screw or bolt, unless a second hole has been made elsewhere by way of afterthought. For many purposes this is sufficient, but it is by no means an ideal construction. Almost any clamp can stand at least another hole, as at *A*, Fig. 4; and three holes in line, as at *B* and *C*, will be better for long ones, especially since they cannot weaken the clamp to any appreciable extent. The extra holes will often allow a clamp to be used immediately in a place where there would otherwise be trouble or delay. In Fig. 5, for instance, if the strap only had one hole in the center, the end of the slot in the faceplate would not allow it to be used at all.

IN PLACING the holes it pays to use some thought. Nothing is gained, for example, by having two holes the same distance away from the ends of a strap like that shown at *A* in Fig. 4. Instead, one hole should be about center, and the other offset, as indicated. Neither is it necessary to have offset holes on both sides unless the two ends of the clamp are different, as at *B*.

An excellent plan for shorter straps is to have a chain of holes, similar to Fig. 6 at *A* and *B*. With the strap so made, the location of the bolt can be changed by small amounts and yet the clamp positively maintained. Since all the strength and every other advantage is retained, there is no reason why a good many of the short clamps should not be fixed this way.

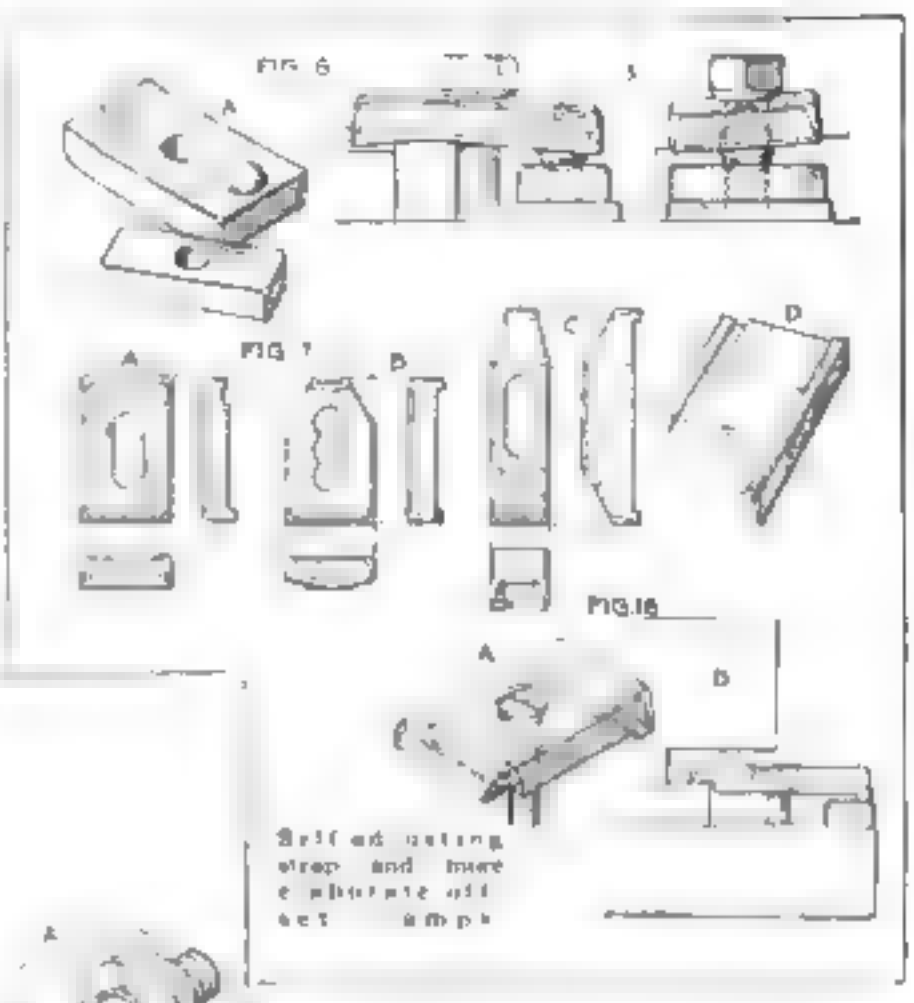
Such a chain of holes can be made in various ways. One way is to drill a small hole exactly centered between the end holes, and then to enlarge it to size with a sharp and well-ground drill, using a slow feed. The proper relation between the diameter of the bolt, hole diameter, and center distances is shown at *C*.

It will pay, however, to have also some clamps with a slot instead of the chain of holes, as in Fig. 7 at *A*. The slot is particularly advantageous when it is necessary to use the strap crosswise of the slot on the faceplate or machine table, as at *B*, since the ideal adjustment relative to the work can be obtained in the quickest way and without the time-robbing operation of changing the bolt from one hole to another.



Ways to hold a clamp in position when loosened, a quick-acting bolt and a pointing cap screw, how to adapt C clamps for use on machines

Before proceeding further with the design of clamps let us turn our attention to the matter of the screws or bolts commonly used with clamps of every description. Here, indeed, there is some room for improvement, and the wonder of it is that mechanics quite generally will get along with things they would condemn as inefficient, were they regular parts of a machine.



Brief cutting strap and more elaborate offset clamps

In the first place, the ordinary cap screws commonly used are made to act on parallel surfaces, but in actual holding practice, the surfaces are often far from parallel, and the condition seen at *A*, Fig. 8, is common. Nor can it always be conveniently avoided by a more careful choice of the blocking, as will be seen from *B*, where slanting surfaces on the part would require undesirable shimming under the end of the strap, unless the strap were ground to a special shape.

WITH only a trivial amount of work, the heads and nuts of cap screws can be given a ball-shaped surface on the under side which, as seen from Fig. 9, allows them a correct bearing in any position. It will be noted that the semispherical area here bears on the edge of the hole in the washer or strap instead of on the face. It is a good plan first to force into the hole in the washer or strap a ball of about the same radius as that used for the screw head and nut, in order to form a narrow bearing surface of the proper shape. Figure 10 at *A* shows a good way of dimensioning the several parts in order to obtain the best effect. It will be seen that the diameter of the hole through the washer or strap is what it should properly be anyway for the sake of clearance.

At *B* Fig. 10, is shown an easy way of forming the semispherical surface on the bolthead and nut. Very little work is needed to grind the bit *a* to the approximate radius, and it is as easy to scratch a diagram of the head and stem, with the radius, on a piece of spring bronze and cut it out to make the gage *b*. It need hardly be said that screws and nuts such as these should be case-hardened—something which should, indeed, be done with almost any screw or nut that (Continued on page 133)

Micrometer No. 11, illustrated above, is designed to have increased measuring capacity. The new shape of the frame at the anvil and spindle ends allows measurements not possible with ordinary micrometers.

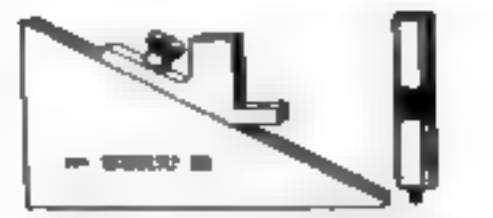
Good Tools Keep Production On A Precision Basis

With American industry always aiming for faster production, there is the constant danger that speed will lead to carelessness—that haste will make waste.

Increased use of precision tools reduces the dangers of increased speed. Brown & Sharpe Tools are at work all over the world making possible rapid work on a precision basis. Brown & Sharpe tool equipment enables manufacturers and mechanics to keep pace with the increasing demands for production.

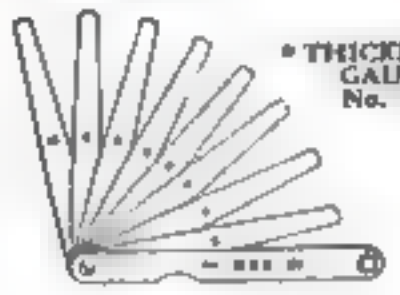
Ask your dealer for Catalog No. 30 listing over 5000 items. Or you may get a free copy from us. Dept. P. S., Brown & Sharpe Mfg. Co., Providence, R. I., U.S.A.

BROWN & SHARPE TOOLS



* PLANER AND SHAPER GAUGE No. 435

* STAINLESS STEEL RULE No. 350



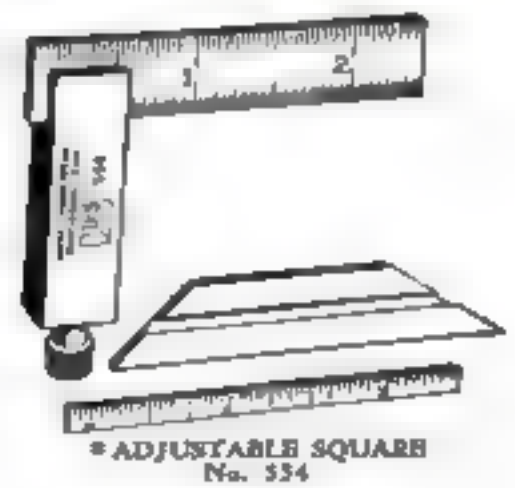
* THICKNESS GAUGE No. 648

* DIE MAKERS' SQUARE No. 553

* COMBINATION SET No. 438

* OUTSIDE SPRING CALIPERS No. 811

* SCREW PITCH GAUGE No. 650



* ADJUSTABLE SQUARE No. 554

* *A description of this tool appears in Catalog No. 30*

"WORLD'S STANDARD OF ACCURACY"

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

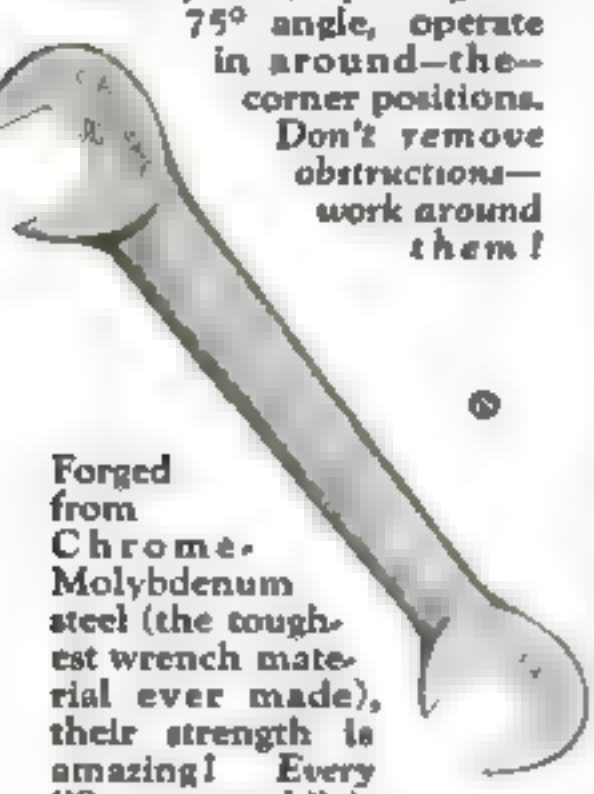
These

Set No. 2040. 5 Obstruction "Superrenches" 10 different openings, 1/8 to 7/8 inch.

PRICE — Post Paid — $5.90 in Leatherette Roll

OBSTRUCTION 'SUPERRENCHES' make hard jobs EASY ~~~

Especially designed for use in close quarters. Slim, pointed jaws and thin heads, with openings at 75° angle, operate in around—the—corner positions. Don't remove obstructions—work around them!



Forged from Chrome-Molybdenum steel (the toughest wrench material ever made), their strength is amazing! Every "Superrench" is guaranteed against breakage. Furnished heat-treated and Chrome-plated, (tarnish proof), heads buffed bright. If your dealer can't supply you, write us.

J. H. WILLIAMS & CO.,
"The Wrench People"
246 Vulcan St., Buffalo, N.Y.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
"SUPERRENCH"
(Chrome-Molybdenum)
OBSTRUCTION SET

Fig. 1. Toy town, made largely of tin cans, which contains houses, power house, factory, farm, and trolley line.

Craft Work *for* Christmas

Tin Can Toys — Doll's House — Santa Claus Novelties — Archery Game — Other Projects

BY UTILIZING a variety of old tin cans, any handy man can make durable Christmas toys at next to no expense.

An example of what can be accomplished is shown in Fig. 1. This is a tin can toy town built by Jack M. Deckard, of Massillon, Ohio. Bean, soup, and tomato cans form the twenty-five houses, which, however, have real glass in the windows and are individually lighted. There is a power house and an electrically operated pump for circulating water through the village. Even the base, which is 7 ft. 9 in. wide and 8 ft. long and is in five sections, was formed by soldering together tin cans. A Toonerville trolley runs through the little town, past the factory district, and out to a miniature model farm on the outskirts.

Edward Thatcher, who is a regular contributor to the Home Workshop Department, is the leading authority on the use of old cans and has written a book, "Making Tin Can Toys," which should be in the library of all amateur craftsmen interested in this work.

AS A gift for a little girl, a doll's house has the great advantage that she can amuse herself endlessly by furnishing the rooms and playing the part of housekeeper.

Good doll's houses are expensive, but one can be built at reasonable cost by following the POPULAR SCIENCE MONTHLY Blueprint No. 72, which gives complete details of the house itself, and Blueprint No. 73, which contains full size drawings of the furniture (see page 102). These blueprints were used by Gus C. Loeffler, of St. Joseph, Ill., in building the house shown in Figs. 2 and 3 for his 13-year-old daughter.

He used 1/4-in. fir veneer for the walls and partitions and glass for the windows, with pasteboard glued on to represent the divisions. The color is gray trimmed with green. The joints between the red chimney bricks were sawed into the wood and painted to represent black mortar. The front and side steps are painted red and striped with black to represent red tiles. The stairs and inside trim are mahogany.

The ship model standing beside the house in Fig. 3 is (Continued on page 94)

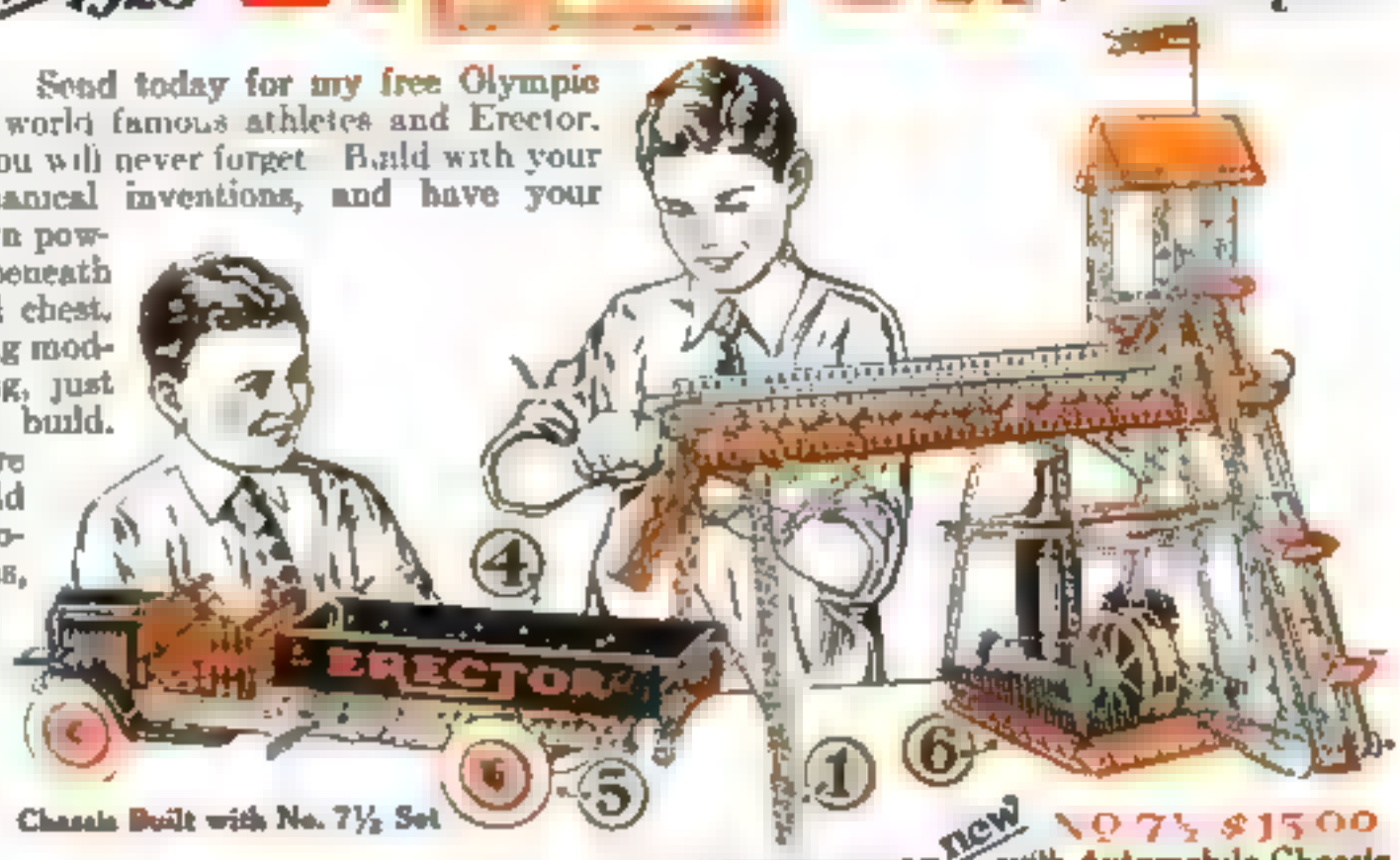
Fig. 2 (at left) and Fig. 3 (above) show a doll's house built from POPULAR SCIENCE MONTHLY Blueprint No. 72, and a Spanish galleon ship model constructed from our Blueprints Nos. 46 and 47.

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Hello boys! Send for your free copy of A.C.GILBERT'S SPORTS BOOK

Tells all about the new 1928 ERECTOR world's sports and champions

Boys! Send today for my free Olympic Sports Book. It's all about world famous athletes and Erector. Erector gives you play days you will never forget. Build with your own hands wonderful mechanical inventions, and have your models operate under their own power. Everything necessary lies beneath the cover of the brass bound chest. Oh boy! What a thrill building models that whiz and hum along, just like the big ones engineers build. With its exclusive and feature patented parts, you can build and operate airplanes, automobiles, trains, steam shovels, locomotives, derricks, bridges, hoisting machinery, power plants and construction equipment of every description and kind. Engineers call it "The World's Greatest Toy."



Chassis Built with No. 7½ Set

new NO 7½ $15.00 with Automobile Chassis

Alfred Gilbert

Why the New [illegible] is the worlds greatest toy

Here's the set I know will give you the greatest thrill you ever had. Fun? Oh, Boy! It's the real thing and there's a thrill packed in every one of its many parts. Boys, this is one great outfit, and there are hours of real sport waiting for you, building automotive models. From the great assortment of distinctive, important, patented feature Erector Parts, you can build 749 models. Automobile chassis, tractors, scooters, service cars, fire engine, and a hook and ladder are only a very few. Packed in a big red brass-bound chest, has big solid steel 14¾ inch truck body, featuring famous combination solid steel model building tray, 100 page manual, powerful electric motor, completely assembled gear box, big red steel disk wheels with oversize balloon tires, fenders, radiator hood bumper springs, steering wheel, heavy truck axles, cab top boiler, digger scoop—in fact, 25 pounds of scientific thrills for every day in the year.

Famous ERECTOR Sets

No. 1—Dandy Beginner's Set. Builds 460 models **$1.00**

No. 3—Gears and Big Red Wheels. Builds 562 models **$2.50**

The Big 4

Famous No. 4 Powerful electric motor, completely assembled gear box, builds 680 models **$5.00**

New Big No. 77 Builds the Steam Shovel. Steel model building tray. Motor and gear box. Builds 727 models **$10.00**

No. 7½—Motorized Erector—Builds the Chassis. Builds 747 models. **$15.00**

No. 8—Trumodel Set. 110-volt Universal Motor. All features described above. More parts. Builds 827 models **$25.00**

No. 10. Giant Fly Wheel. Contains every feature. Over 2,000 pieces. 110-volt motor. Builds unlimited models. **$50.00**

Erector Accessory Sets

No. B Set Big Girder Set. Builds the Ferris Wheel. Builds 57 models **$8.50**

No. 3005 Electrical Set—Electrifies and illuminates **$5.00**

No. C Set—Erector Airplane Set..... **$10.00**

Patented Trumodel Features.

1—Erector Square Girder. Like real girders engineers use. Exclusive feature. Makes sturdy strong models of Erector Sets.

2—Erector Motors. Powerful battery motor in No. 4, No. 77 and No. 7½. Famous 110-volt Universal Motor in No. 8 Trumodel Set and up.

3—Completely assembled gear box, adaptable to every possible gear combination, and reversing movements. Converts drive to 3 drum hoisting engine. Standardized for use with battery or 110-volt motor. Assembled in No. 4 set and up.

4 Heavy solid steel truck body. 14¾ inches long. Complete unit. Exclusive feature. In No. 7½ Set and up.

5 3½ inch solid steel disk wheels. Balloon tires. Exclusive feature.

6 Big Giant Channel Girders, straight and curved. Exclusive feature in No. 77 and up.

7 Large solid steel model building tray. Standard holes for model building. Exclusive patented feature. Many other exclusive and patented features.

SENSATIONAL NEW 1928 FEATURES

1 Multi-unit control. Gives realism. Insures successful operation.

2—Famous 110-volt Universal Motor.

3 Patented machine frame foundation. Exclusive Erector Control part. Adaptation makes possible genuine machinery models.

4 New Giant Channel Girder. Straight and curved. Adapted from patented Erector channel girder, retaining all its features.

5 Duplex Base Plate. Double standard holes possible to use axles of two sizes and increase adjustment adaptability. Exclusive patented feature.

6—Cone Pulley. Helical Gear. Cams. Rack, etc.

A. C. Gilbert's Radio Sports Talks

Get our free big radio booklet. It tells Monday night at 8 P. M. Eastern Time, 7 P. M. Central Time. Tells you how to get our stations now. Pick out your station now.

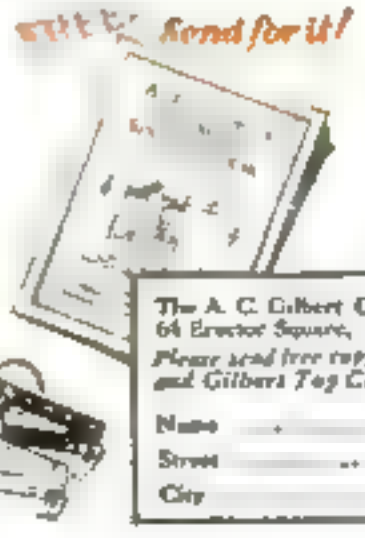
WEAF New York
WJAR Providence
WBZ Springfield-Boston
WRC Washington
WCAE Pittsburgh
WSAI Cincinnati
WWJ Detroit
WSAI Cincinnati
WCSH Portland
WGR Buffalo
WTAG Worcester
WCAU Philadelphia
WJAR Providence
WEAN Providence
KDKA Pittsburgh
KYW Chicago
WSAI Cincinnati
WLW Cincinnati
WTIC Hartford
WFI Philadelphia
WRC Washington
KPRC Houston
WOAI San Antonio
WFAA Dallas
WOAW Omaha
WOC Davenport
WHO Des Moines
WCCO Minneapolis-St. Paul
KSD St. Louis
WMC Memphis
WSB Atlanta
WBAP Fort Worth-Dallas
KPO San Francisco
KFI Los Angeles
KGO Oakland
KOA Denver
KFOA Seattle
KHQ Spokane
WJZ New York
WBAL Baltimore
WJR Detroit
WLS Chicago
KMOX St. Louis
KSTP St. Paul-Minneapolis
WHAS Louisville
WSM Nashville
WSMB New Orleans
KTHS Hot Springs
KPRC Houston
WOAI San Antonio
WBAP Fort Worth-Dallas

And 48 stations in entire Red Network

A. C. Gilbert's Olympic Sports Book

Knows All About the Greater Erector

Get the whole story with a series of exciting sports talks by America's most famous athletes. Coupon brings this free to you. Mail it today.



3-step worm drive with PSG 110 Volt Motor.

The A. C. Gilbert Company. New Haven, Conn.
64 Erector Square,

Please send free copy of A. C. Gilbert's Olympic Sports Book and Gilbert Toy Catalog.

Name
Street
City State

PLUMB

SCREW DRIVERS

do not break, bend or twist.

Made from special *Tungsten* — steel, hand-forged and heat treated throughout.

The square shank runs clear thru the handle to the steel cap.

It is springy and tough and will withstand unusual prying and hammering. The octagon handle insures a firm grip.

All Sizes Sold by leading Hardware Dealers, Plumbing and Automotive Jobbers.

The standard of hand-forged tools for 20 years for the Auto Mechanic, Plumber, Steam Fitter, Carpenter and other Artisans.

Every PLUMB hand-forged tool is fully guaranteed. See Display Board at your Dealers.

PLUMB TOOL CO.
2209 Santa Fe Ave.
Los Angeles

Send for this

A sample of PLUMB quality

This hand-forged key-ring screw driver, sent for 12c in stamps

Name .....

Address.....

Write Name of Dealer in margin

PLUMBING GARAGE GENERAL

Interested in PLUMB tools for ☐ ☐ ☐

Craft Work *for* Christmas

(Continued from page 88)

A Spanish Galleon made with the aid of our Blueprints Nos. 46 and 47.

FOR Santa Claus decorations on his Christmas tree, A. H. Scriven, of Dallas, Texas, makes acorn dwarfs, as shown in the decorative drawings below. He developed these after having constructed most of the so-called "conicults" described by F. Clarke Hughes in past issues of POPULAR SCIENCE MONTHLY.

Gifts to Make

WHEN Christmas rolls around, any ingenious home worker can turn out gifts in unlimited variety. The work is good fun, the [illegible] at this time of the year, and the gifts are certain to be appreciated more than ordinary store goods.

For suggestions turn to page 107 and run through the partial list of POPULAR SCIENCE MONTHLY blueprints, at usual for a complete list. The toy blueprints are Nos. 19 28, 29, 48, 56, 63, 64, 67, 72, 73 and 101. Gifts for women: Nos. 1, 9, 13, 17, 27, 31, 38, 46, 48, 88, 91, 93, and 100. Radio sets: Nos. 42, 43, 54, 55, 79, 80, 81, 97 and 98. Gifts for men: Nos. 2, 15, 30, 37, 65, 68, 77, and 78. These are only a few hints. The point to remember is that for a nominal sum you can obtain complete working drawings for any one of seventy-five well tested projects, including ship and airplane models.

An acorn which has a small or deformed acorn attached to the "saucer" is the best to use. Holes are made with an awl to represent the eyes and mouth, and a bit of bark is whittled for a nose and attached with glue. A few strands of cotton are twisted to form the mustache. Glue is smeared over all the acorn except the "face," and cotton is dabbed on to represent hair and beard. Eyebrows may be made with cotton or put on with white ink. By whittling a body of soft pine, a more elaborate dwarf may be created. Pieces of autumn leaves are glued to the body for clothes and shoes, and two small twigs form the arms.

HERE'S a way to enjoy archery indoors. If you have a circle of friends in for the evening, there's bound to be keen competition and riotous laughter. Regular archery contest rules govern the game.

To make the bow or bows—you will need three or four if you wish to have a party—obtain a number of turkey wing feathers. They are all the better if from a bird killed last year. Dealers in archery supplies and feather dealers always carry turkey wing pointers.

Cut the end of one quill just above the tip and, covering the tip of another with glue, force it into the cut quill to make a bow as shown in Fig. 4. A bit of adhesive or electrician's tape wound about the joint and covered with velvet or felt forms the handle.

Arrows, of which you will need three for each bow, are made from turkey tail feathers. Trim off all the vanes, except those needed for feathering, and notch the small end slightly. Straighten the quills by immersing in hot water for an hour or two. Cut back the tips of the quills slightly and insert a needle-pointed shingle nail, embedded in sealing wax. The arrows will fly thirty or forty feet with speed and accuracy.

Still better arrows may be made from pieces split from long joints of an ordinary cane fish pole. In making the shafts round with knife and sandpaper, be careful to retain a portion of the hard outer layer of the cane. A few cuts of the knife serve to point these, for the cane is hard. They must be fletched (feathered) with bits of feather glued on.

The target may be made from unbleached muslin, marked as indicated with stenciling colors. If only one thickness of cloth is used, arrows will sometimes pass through; consequently it is better to make the target double, padding it with an inch or so of cotton batting. An iron barrel hoop or stiff piece of wire helps to hold the target in shape and permits standing it in a corner, on an armchair, or against the wall. If the target is larger than 18 in. in diameter, it will be more likely to catch wild shots, which otherwise might damage walls or furniture. This can be avoided, however, by hanging a folded blanket back of the target.—J. V. HAZZARD.

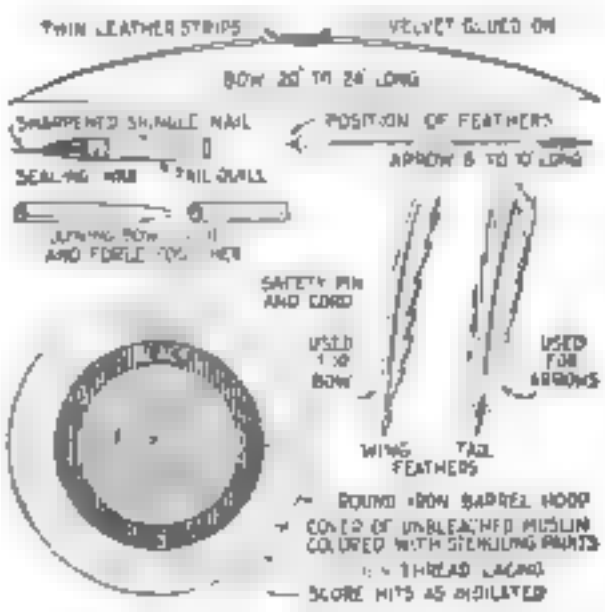
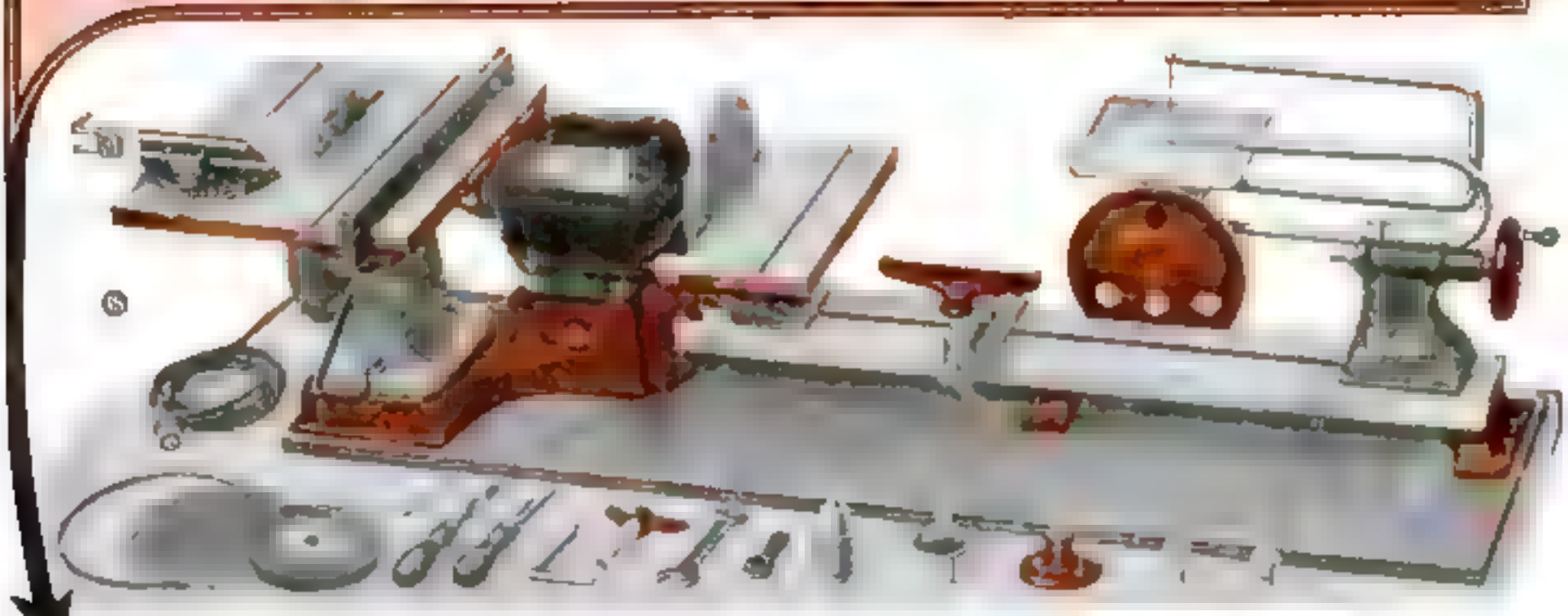


Fig. 4. Bow made from feather quills and arrows and target for use in indoor archery.

20 New Big Exclusive Features in the 1929 Model "Delta" Electric Handi-Shop



New Features of 1929 Model

found *exclusively* in the "Delta" Handi-Shop, in addition to the many regular exclusive advantages, make this shop one of the finest values in the workshop field. A few of the new improvements are

For full details, send coupon below.

Make the Things You Have Always Wanted to Make

With this convenient, practical workshop. It's *so easy* and *so quick!* Save money on repair work. Earn money in your spare time. Complete instructions furnished. With each Handi-Shop is included, at no extra cost, complete set of working drawings. Below are a few of the hundreds of articles you can make in a jiffy with a Handi-Shop.

Blue Prints Included

Scores of Exclusive Advantages in this Big Husky Home Workshop

The DELTA Handi-Shop is a man-sized, motorized workshop, complete, efficient and PRACTICAL IN DESIGN! Does everything from building full-sized furniture, turning table legs, to finishing delicate detail work. Study the illustrations carefully. Note the **two-shaft motor** that permits two or three operations **at one time**—the heavy Triple Foundation U-Shaped Lathe Bed (no rods)—the *practical* arrangement of the Circular Saw that permits the cutting of large lumber without interference—the improved Tilting Tables on the Circular Saw, Sanding Disc, and Jig Saw, with many exclusive features. Has automatically oiled bronze bearings and is completely assembled on heavy veneered wood base.

This combination of advantages, plus many more, IS FOUND EXCLUSIVELY in the DELTA HANDI-SHOP! No wonder even last year's Handi-Shop was an outstanding value. And now, with the many additional exclusive features of the new 1929 model, this shop is in a class by itself — above all comparison — at a new price that is surprisingly low!

This [illegible] motor is THE [illegible] important operations at one time — without continually dismantling the set-up.

ALL DELTA UNITS have 20 in. lathe capacity between centers

This Heavy Triple [illegible] is [illegible] to spring or shimmy

10 DAY TRIAL in Your Own Home

without obligation. See how PRACTICAL, how EFFICIENT it is. Actually try it out under actual working conditions. Prove to many of your friends what a wonderful Handi-Shop you have. Equipped with all necessary equipment for Circular Sawing, Woodturning, Jig Sawing, Sanding, Drilling, Grinding and Boring.

Easy Terms

Then if you decide to keep the Handi-Shop you can have your choice of three convenient methods of payment.

Send Coupon

at once for Free beautifully illustrated literature giving complete description of the New 1929 Model "Delta" Handi-Shop with its many exclusive advantages and new features. Also full details of the 10 Day Trial Offer and Convenient Payment Plans.

DELTA SPECIALTY CO.
1661-67 Hollton St. Milwaukee, Wis.
Dept. S. 128

WRITE FOR THIS VALUABLE BOOK

crammed full of practical information on how to construct [illegible] projects. Helpful [illegible] pictures, diagrams, illustrations, charts and [illegible] information on [illegible]. If you want this book send 10c, which merely covers cost of mailing. See coupon below.

DELTA SPECIALTY CO. Dept. S 128
1661-67 Hollton St. Milwaukee, Wis.
(Check material desired)

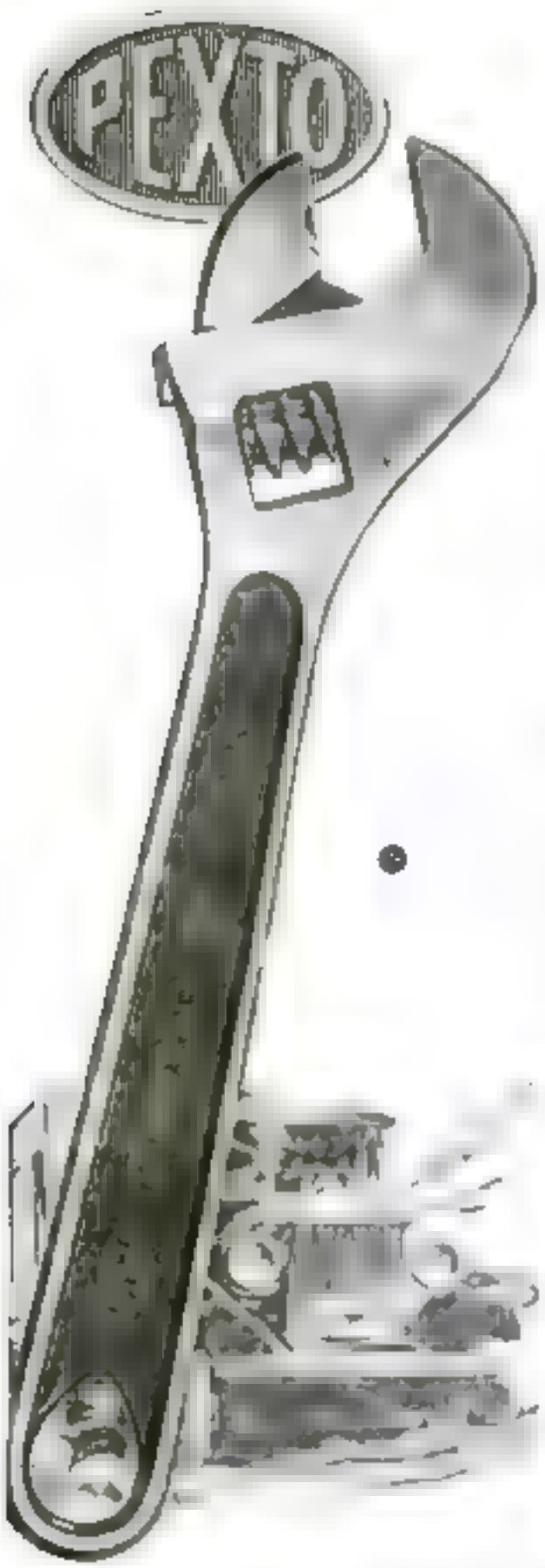
☐ Please send, without obligation, FREE Illustrated literature describing new 1929 Model "Delta" Handi-Shop. Also full details of 10 Day Trial Offer and Easy Payment Plans.

☐ Please send me copy of "How to Make Things with a Workshop." I enclose 10c to cover cost of mailing.

Name .....

Address .....

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 5.



Why - - -

is there a need to choose tools carefully? The finish and polish on many kinds of tools may be the same. But you need to go further when you select a tool that you expect to last a lifetime. Keep in mind the exact balance, fine quality, and guaranteed material built into every Pexto Tool.

A few of the popular items in the Pexto line are Braces, Bits, Chisels, Hatchets, Pliers, Pruning Shears, Screw Drivers, Snips, Squares, Wrenches, Hammers and other small tools.

Send for booklet, "S"

THE PECK, STOW & WILCOX CO.,
Southington Connecticut

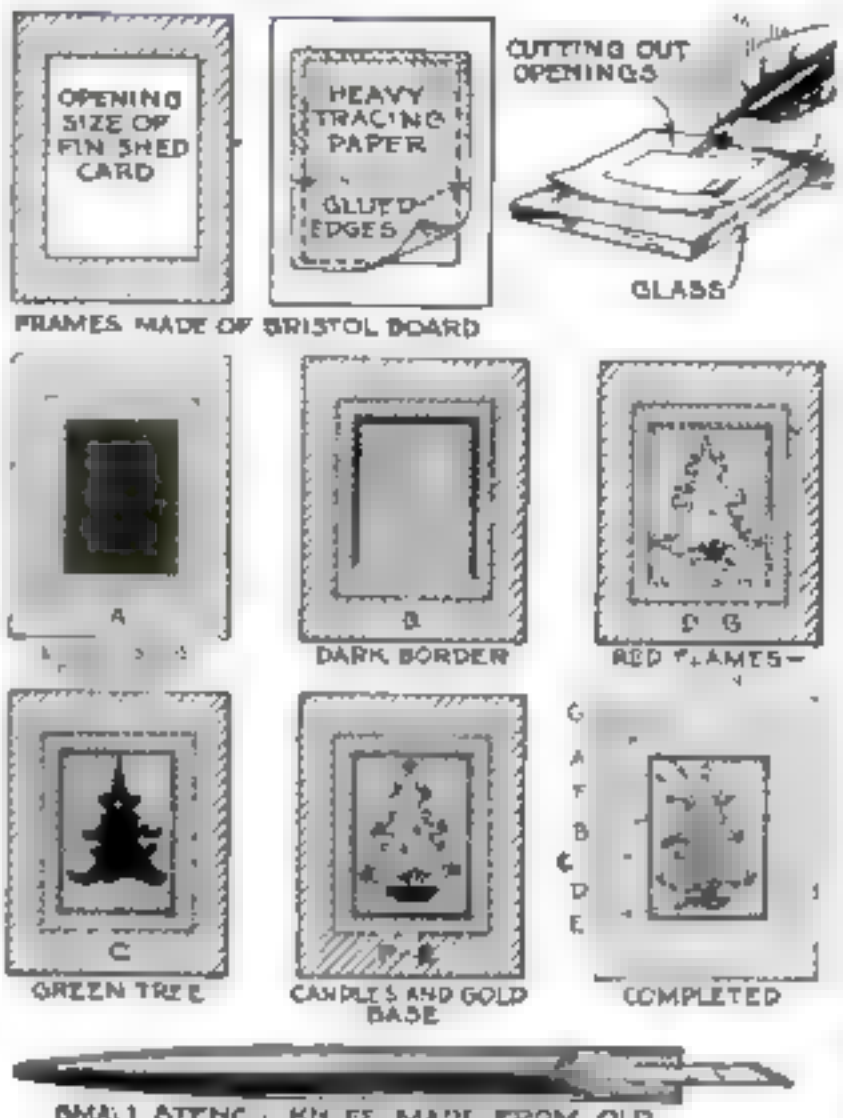
Stenciling Christmas Cards

(Continued from page 91)

of a size and shape that will allow the edges to be adjusted so as to register the different parts in their proper places, much the same way as the printer makes use of his color plates in printing an illustration.

After the design to be used is carefully planned, count how many different parts or colors there must be. Refer to the illustration at the right, and you will see the idea at a glance. In the case of the Christmas card with the tree and candles, there will be five different stencils; one for the background, one for the border, one for the tree trunk and the red candle flames, one for the foliage, and one for the white candles and the gold base and star.

It will be noticed that there are two colors on both the sheet marked *D-G* and that marked *F-E*. Two colors always can be used in this way if they are far enough apart to prevent any overlapping of the brush strokes.



How the blank stencils are made by mounting heavy tracing paper on cardboard frames, a set of stencils and a stencil knife.

When the number of stencils has been figured out, the blank stencils should be prepared as shown. Use a medium weight parchment or draftsman's tracing paper mounted on the frames of bristol board or cardboard. The frames should be the same size as the finished card, and all of them exactly the same size. They are to strengthen the thin paper.

After the frames are made and the blank stencils are mounted, they may be laid directly over the face of the drawing or design and each part traced with a lead pencil. Be careful that they collectively register in their correct position in relation to the others of the set.

When the different parts are traced, the stencils may be cut out very easily by laying the paper on a slab of heavy glass and drawing the blade of a small, sharp penknife along the lines. A practical knife for this small stencil cutting may be made by driving a small piece of razor blade or thin steel into an old wooden penholder. The cutting of the lines must be clean and smooth.

The stencils, after being cut out, should be shellacked with a brush or spray to make both sides waterproof, after which they should be given a trial on a piece of smooth paper to see that all of the parts register correctly. The sheets are now ready to use in making from one to a hundred impressions on as many finished cards.

For the paper or card stock, correspondence cards with paneled centers and gold edges are excellent; when they have the envelopes to match, the effect is all that can be desired. If a folder is preferred, tinted stationery with rough edges may be stenciled attractively.

The actual stenciling should be done with opaque water colors, preferably the ordinary show card colors. The colors should be rather (Continued on page 144)

After the designs are traced on them, the stencils are cut with a very keen blade.

The stenciling is done with show card colors applied with a bristle brush held vertically

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

MY DEFINITE PROPOSITION TO YOU

A SUBSTANTIAL CASH PROFIT IS WAITING FOR YOU!

Yours for the Asking

Trivial Down Payment

Free Trial and Instructions—Free Plans and Materials

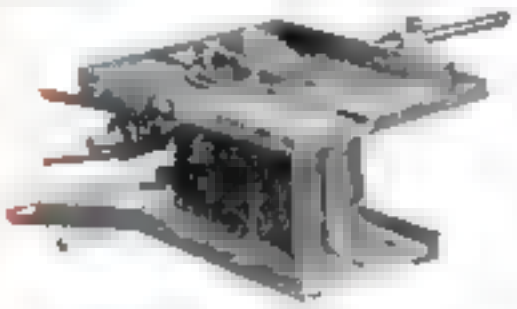
24 Blue Prints Free

Free Crafts Books

Quick Action Needed

Handy Jig Saw

Practical Bench Saw



Discard Your Hand Tools

Get Your Magazine Basket Quick!

Motorize Your Workbench

MAIL TODAY!

Electro Magnetic Tool Co.
Dept. 5-D 1832 So. 52nd Ave. Cicero, Ill.

Name

Address

City State

ELECTRO MAGNETIC TOOL CO.
Department 5-D 1832 So. 52nd Ave.
Cicero Adjoining Chicago Illinois

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

You Will Notice the Difference

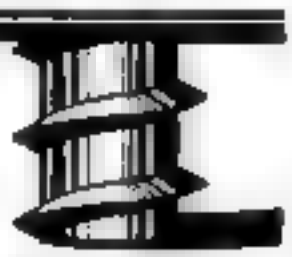
When You Use AMERICAN Screws

AMERICAN Screws are easy to start, easy to drive—and once inserted they stay in place.

AMERICAN Screws have sharp, gimlet points, true running threads and slots that stand the strain of heavy handling.

You will be interested in our booklet, "Wood Screws." Copy will be sent to you on request.

Your hardware dealer will supply you with the proper AMERICAN Screw to do any job.



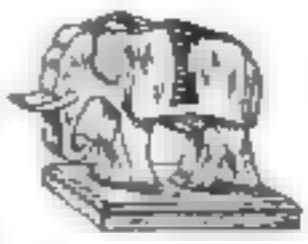
MACHINE SCREWS · WOOD SCREWS · TIRE BOLTS · STOVE BOLTS

AMERICAN SCREW CO.
PROVIDENCE, R. I., U.S.A.
WESTERN DEPOT,
225 West Randolph St. Chicago, Ill.

Put It Together With Screws

Novel Cigarette Holder Shaped Like Elephant

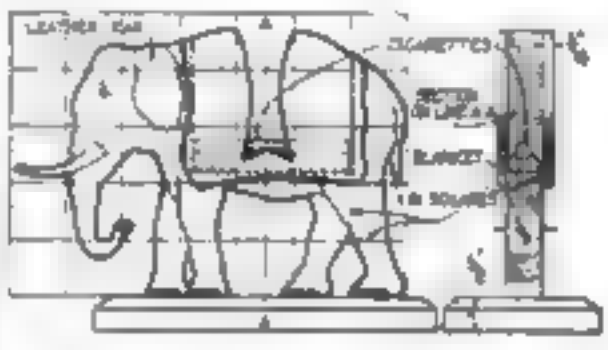
SHAPED like an elephant, the attractive little cigarette holder illustrated forms an ornamental addition to any smoking table. It can be constructed very easily from stock $\frac{3}{8}$ or $\frac{1}{2}$ in. thick and two pieces from a cigar box or other thin wood.



Elephant carrying a load of cigarettes.

On one of the thicker pieces, 5 by 7 in., draw 1-in. squares and copy the figure of the elephant. Cut this out with a coping saw, removing the part in the back marked with heavy dotted lines. Add the sidepieces (blanket) and mount the elephant on a base $2\frac{1}{2}$ by 6 in.

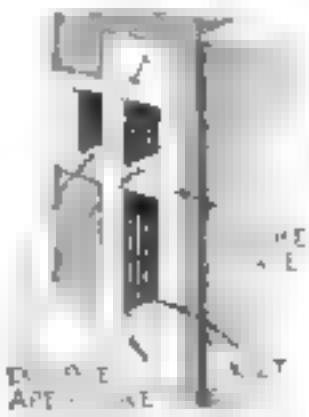
Paint the base green, the elephant gray, and the blanket red, preferably with brushing lacquer. Add the markings in red, and apply ears cut from a piece of thin leather.—KENNETH R. LAVOY.



How to lay out the elephant's body, the pieces forming the blanket, and the base

Keeping a Storm Door Shut

ON MANY storm doors the catch does not engage the latch strike plate if, because of a high wind or for other reasons, the door is not shut hard by its spring. The result is that the door remains open part of the time. A method of getting around this difficulty is to drill and file another opening in the outstanding section of the strike plate, as illustrated. Then if the catch does not make connection with the original opening it at least will hold in the new aperture.—R. P. LINCOLN



An extra opening is made in the strike plate.

Putty for Hardwood

A DURABLE putty for nail holes and cracks in hardwood which is to be varnished can be made by mixing a little dry white lead powder with high-grade linseed oil and whiting putty and adding a very small amount of japan drier to make a stiff paste. This can be tinted with burnt sienna to match mahogany, Vandyke brown to give walnut shades, and raw sienna for oak and other light woods. Either colors ground in oil or dry colors may be used for tinting the putty.

A pound of cheer to start the year!

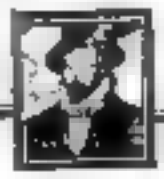
WITH the Yule log burning brightly and a pound canister beside him of the mildest, most fragrant pipe mixture that ever came out of the South—what more could a man ask? Give him the pound can of Sir Walter Raleigh Smoking Tobacco for Christmas. It's protected inside by heavy gold foil and the canister comes in a handsome Christmas carton.

Brown & Williamson Tobacco Corporation,
Winston-Salem and Louisville

B&W

SIR WALTER RALEIGH

Who discovered how good a pipe can be

It's  *milder*

The six-fingered hand

Tycos

THE SIXTH SENSE OF INDUSTRY

The Butcher
The Baker
The Candlestick-maker

and so the rhyme goes on through practically every division of Industry.

INDICATING and Controlling Thermometers for the Packing and Canning Industries. Instruments and Pyrometers for Annealing and Baking Operations.

Every type of temperature or heat controlling instrument for the baker, the textile mill, the candy factory, refrigeration plant.

On and on, almost indefinitely, the list of types and applications of *Tycos* Temperature Instruments extends. Controlling the quality of a product here, eliminating spoilage there; oftentimes they are the major units which make possible, intricate processes of heat treatment

If you manufacture any product in which heat treatment enters into its preparation—there are *Tycos* Indicating, Recording and Controlling Instruments made especially for your purpose that will save waste and control the quality of your product.

Informative literature on any type of instrument will be sent upon request or better still, our engineer will consult with you on the application of *Tycos* to your particular problem.

Tycos for the Home

Tycos Office Thermometers
An aid in promoting human efficiency

Tycos Bath Thermometers
To enable you to get the most good from your bath.

Tycos Home Set
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Wall Thermometers
To help you to maintain a temperature in your house conducive to good health.

Tycos Quebec Compasses
To show you the right way in unfamiliar country.

Tycos Fever Thermometers
A necessity in every home.

Tycos Storm-guide
Forecasts the weather twenty-four hours ahead with dependable accuracy

Tycos Hygrometer
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Tycos for the Medical Profession

Tycos Sphygmomanometer, Recording Pocket and Office types.

Tycos Fever Thermometers.

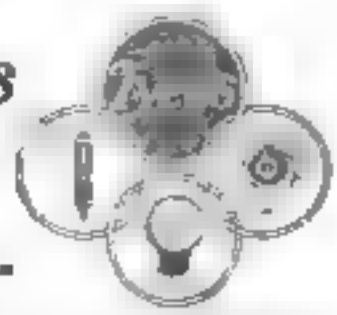
Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

Bulletins on Request

Taylor Instrument Companies

Main Office and Factory
ROCHESTER, N. Y. • • U.S.A.

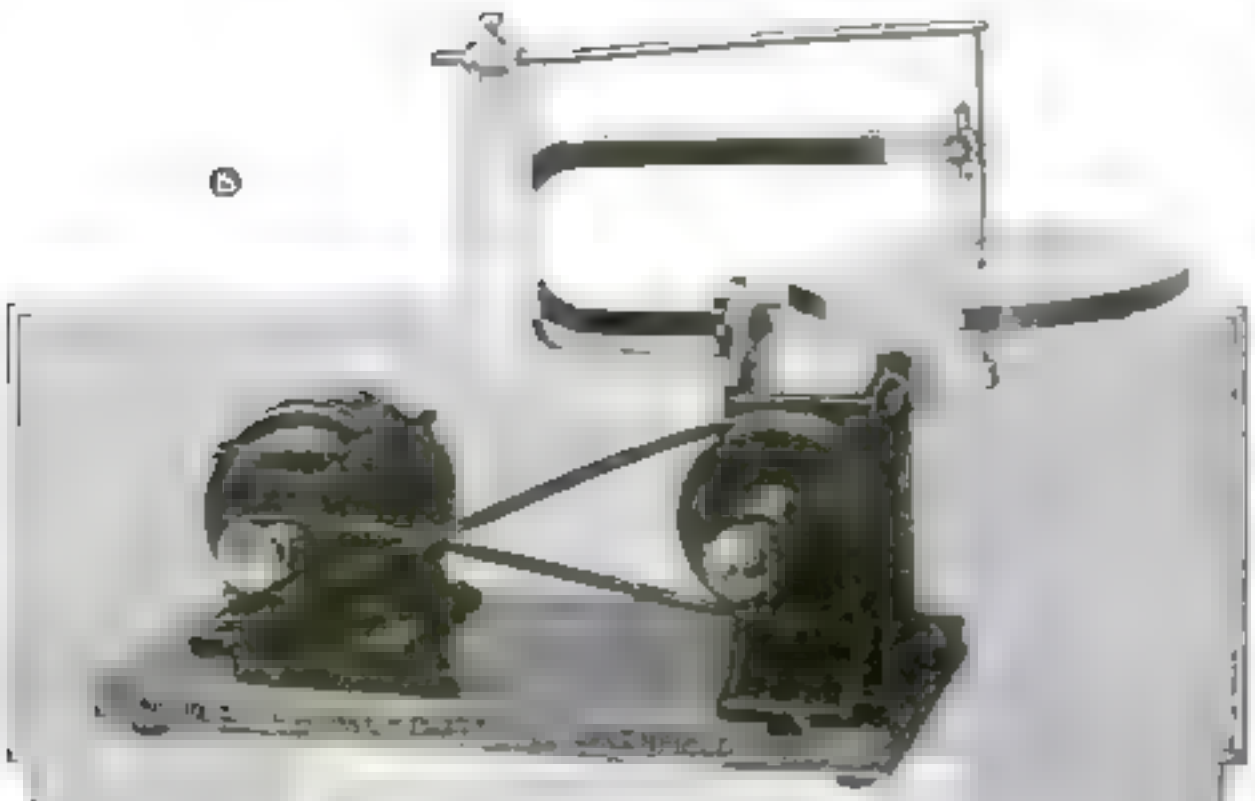
Canadian Plant: 100 BUILDING, TORONTO
SHORT & MASON, Ltd., Manufacturing Distributors in Great Britain



THE ~ SIXTH ~ SENSE ~ OF ~ INDUSTRY

Tycos Temperature Instruments

INDICATING - RECORDING - CONTROLLING



Make the long winter evenings shorter!

You can do it with one of these Motor Driven Scroll Saws. It's a real tool—a Goodell-Pratt Tool—and there are a thousand and one uses for it

Increases range of work

You can do these jobs yourself which you do otherwise have to have done for you, and save both time and money

Fosters pride of accomplishment

With this saw, you'll derive the satisfaction which can be had only when you have done *all* the work yourself...the pride of the creator and builder.

Saves you time

Think of how much more work you can do, and do it better...more accurately, and of the real pleasure you'll derive from working with a tool which is designed right, made right and priced right

No. 1075 Motor Driven Scroll Saw $36.00

If your dealer hasn't one of these in stock and cannot supply you, write us direct

GOODELL-PRATT COMPANY Industrial
GOODELL-PRATT
500 GOOD TOOLS

Special Plate Used for Grinding Chuck Jaws

UNIVERSAL chuck jaws are frequently ground on the inside while they are expanded into a ring, which serves to keep them rigid. This method is about the simplest, yet it violates all principles of accurate work.

In order for the jaws to hold work accurately, they must be ground in the same position as if they were in use. This means that when they are ground, they should be closed in on something, rather than opened out into a ring. There

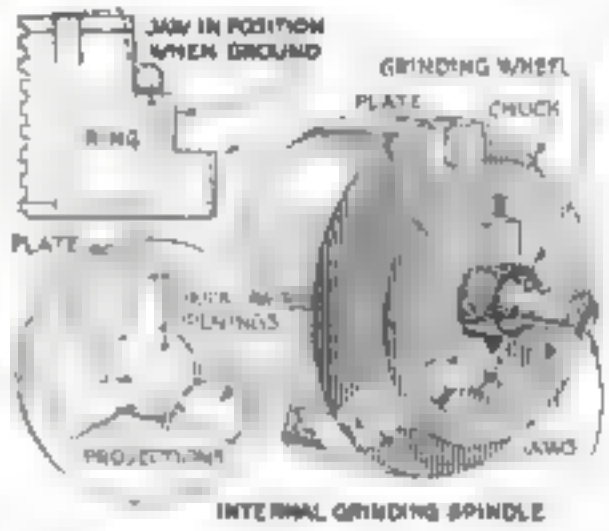


Plate method of grinding chuck jaws, why the common ring method is not so good.

is always play of some sort in the scroll, and the wear may not be everywhere uniform. Therefore, if the jaws are ground while expanded into the ring, they will not be true when they are clamped on a piece of work. How they are apt to be deflected is shown by the dotted lines in the diagram in the upper left-hand corner of the illustration.

The other views of the illustration show the application of a plate made of ½-in. steel for holding the jaws while they are being ground. This plate has three slots with projections at the inner ends on which the jaws exert a slight pressure—just enough to take up all the slack. The jaws are held in the same relation to the chuck body as when they are later used to clamp work.—FRANK L. YOUNG.

How to Magnetize a Drill

DRILLINGS can be prevented from taking shape a manifold if a magnetized drill is used for making whatever holes are necessary. Any drill can be magnetized in the following manner:

Make a spool of brass or fiber tubing 3 in. long, with an opening through the core to allow the drill to fit loosely. Wind five layers of No. 18 insulated copper wire on the spool, place the drill in the central hole, and connect the terminals of a storage battery to the ends of the wire. Pull the drill part way out of the core while the current is flowing and tap it lightly with a small hammer. It takes only a few seconds to magnetize the drill.

Drill slowly as the point breaks through so as to give the magnetized drill more chance to collect particles of iron. It is also a good idea to remove the drill from time to time and brush off the drillings.

A drill once magnetized remains so permanently. WALTER L. MCMULLEN

Lionel Trains with 100% Distant-Control

A movement of the switch at any distance from the track and your LIONEL will start, and stop, and reverse itself at any speed, with the precision of a real railroad train.

You don't have to touch the train! It's all done electrically by means of LIONEL'S marvelous 100% "Distant-Control", with you as the operator at the Switch Tower. Signals change, crossing gates raise and lower themselves, warning signals flash red and green as the semaphore arm goes up and down, controlling perfectly the movement of your train. With a LIONEL model railroad you learn the principles of electric railroad operation—so true to life is every detail. And remember that only LIONEL can produce such handsome, accurate copies of actual railroad locomotives and cars!

See the wonderful LIONEL demonstrations at all Toy, Hardware, Sporting Goods, Electric, Furniture, and Department Stores.

By means of Lionel's 100% "Distant Control" one or more trains can be operated on a series of tracks—quickly and positively controlled by any boy from his post at the New Lionel Power House No. 240 shown above.

THE LIONEL CORPORATION *Dept.* 2 15-17-19 East 26th Street NEW YORK CITY

"STANDARD OF THE WORLD SINCE 1900"

LIONEL ELECTRIC TRAINS

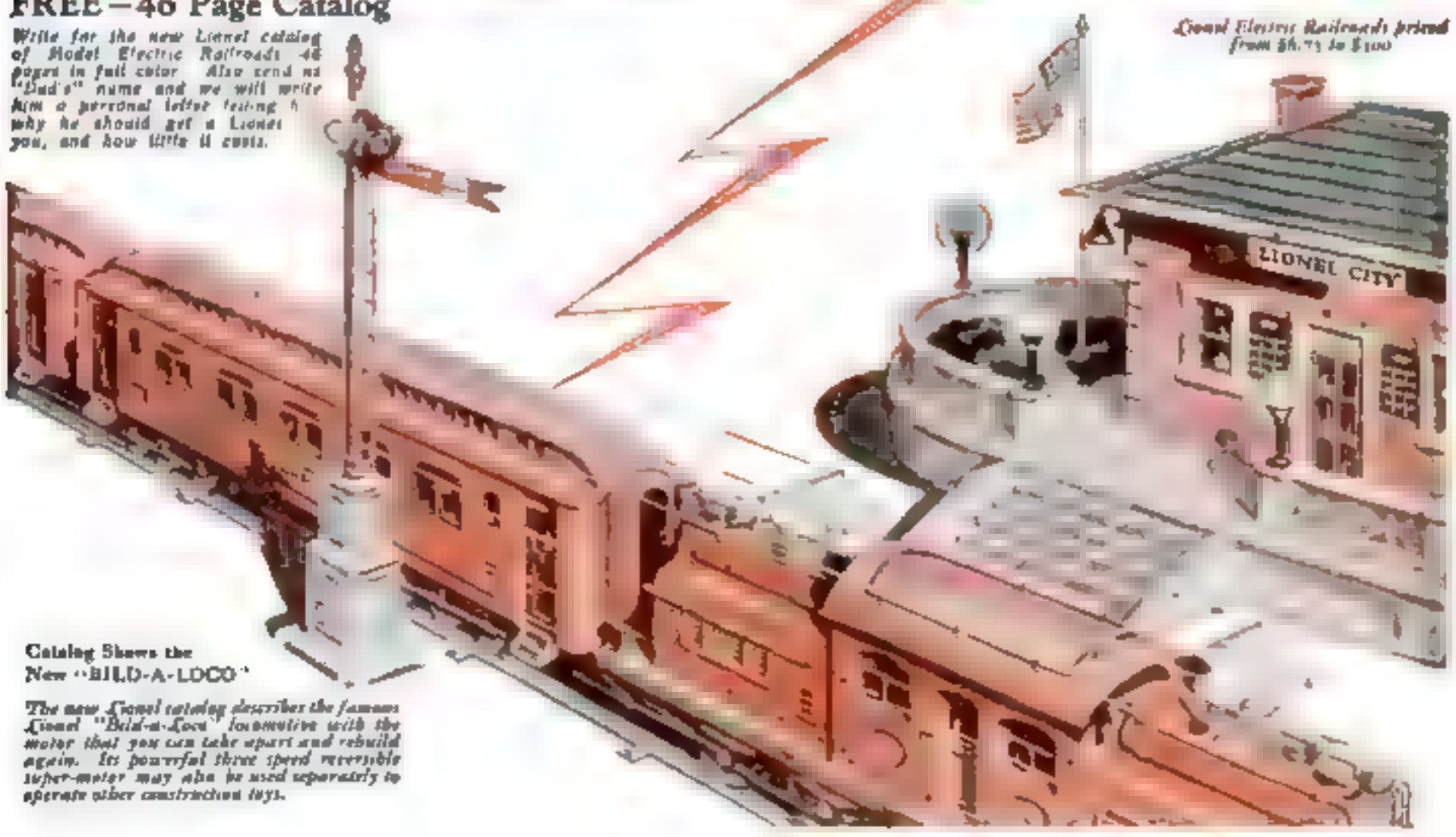
MODEL RAILROAD ACCESSORIES

"MULTIVOLT" TRANSFORMERS

FREE—46 Page Catalog

Write for the new Lionel catalog of Model Electric Railroads 46 pages in full color. Also send us "Dad's" name and we will write him a personal letter telling h why he should get a Lionel you, and how little it costs.

Lionel Electric Railroads priced from $6.75 to $100

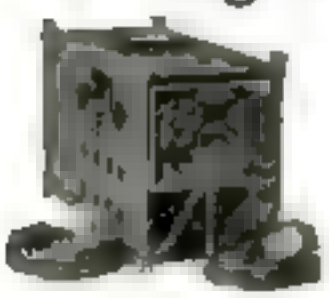


Catalog Shows the New "BILD-A-LOCO"

The new Lionel catalog describes the famous Lionel "Bild-a-Loco" locomotive with the motor that you can take apart and rebuild again. Its powerful three speed reversible super-motor may also be used separately to operate other construction toys.

Your Present Radio

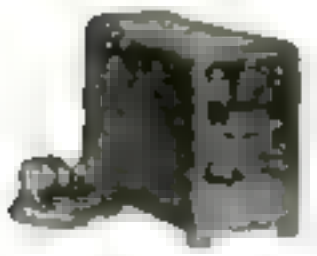
. . can be made an Electric A.C. Set *without changes in wiring or even the cost of new tubes*



Kuprox A.C. Power Pack. Makes any battery set an electric A. C. receiver. $33.50 up.

THERE'S no necessity for discarding a good battery operated receiver to get the convenience of A. C. operation. The Kuprox A. C. Power Pack converts any good set into an electric A. C. set, without changes of any kind in wiring, without the use of harnesses or adapters.

Kuprox equipped, your present set, using your present tubes will give you super-fine A. C. operation. Everything your radio did before, it will do even better. And there's nothing to bother about . . . the entire set turns on and off at your light socket. The Kuprox A. C. Power Pack is a permanent addition to your set that will double your radio enjoyment.



Kuprox Multi-rate Rectifier, for trickle charging, dynamic speaker operation, etc. $11.50

Several models are offered. One that supplies all radio power for any size set. Or separate filament and plate models for those who desire this form. And an efficient "A" model that supplies filament current and will operate in conjunction with any good "B" eliminator. Priced from $32.50 up. See the various models at your radio dealer's. Or, if you first desire more information, we'll be glad to send it if you will write.

Kuprox Replacement [illegible] eliminates acids, liquids, [illegible] trickle charger $5.00

TELEVISION! Kuprox A. C. Power Packs are necessary for operating television receptors, which require perfectly smooth D. C. current for motor supply, filament, plate and glow circuits.

THE KODEL ELECTRIC & MFG. CO.
Formerly The Kodel Radio Corp.
500 E. Pearl St. . . Cincinnati, Ohio

KUPROX A.C. POWER PACK

Santa Claus Figure Rings a Bell on Christmas Tree

By CARL G. ERICH

A SMALL figure of Santa Claus stands beneath our Christmas tree and, by pulling a cord, rings a tiny bell in the boughs above him. His motions are spirited and life-like. What inspires the little old fellow's activity is a continuation of the string, which runs unnoticed along the floor to the real bell-ringer, who pulls it at will.

Bell-ringing Santa Claus in position beneath the tree.

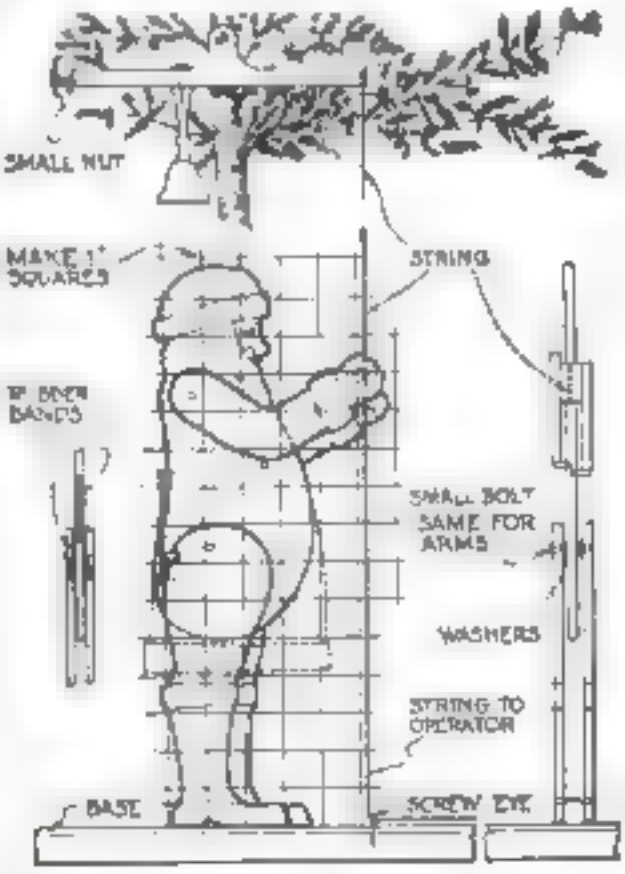
I sawed the figure from three-ply veneer. I set one leg a little ahead of the other and one arm a little lower than the other, using small bolts as pivots, and passed three small wooden plugs on each side for stops. Two small stout rubber bands were fastened to small wire brads in the rear of each leg and in the back of the body. The rubber bands pull Santa upright after he bends.

A small block was nailed between his hands and a hole drilled through it to let a thin string through. The string, which was plugged into the block, runs down to a small screw eye in the base.

I used red felt for Santa's trousers, coat, and cap, and trimmed them with white felt. Cotton served for his whiskers.

A block was fastened between the feet and then nailed down on a solid, heavy base.

The bell was mounted on a strip of wood and the wood in turn fastened loosely to the tree as shown.



Side and front views of the figure, and detail showing how the bell is fastened above.

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

THEY'RE THERE

IN THE WORLD'S FINEST RECEIVERS

STANDING guard at the door of tone, Thordarson audio and power transformers do their part in making real musical instruments of hundreds of thousands of radio receivers annually.

Leading receiver manufacturers are well aware of the important relationship between the choice of transformers and the musical characteristics of their instruments. No wonder, then, that the majority of manufacturers of quality radio receivers have turned to Thordarson as the logical transformer source.

When buying your receiver, insist on Thordarson amplification and power supply. The set manufacturer who uses Thordarson transformers can be depended upon to have the balance of his receiver in keeping with this high standard of performance.

Custom set builders will find Thordarson transformers to meet every radio need at their nearest parts dealer.

THORDARSON
RADIO TRANSFORMERS

SUPREME IN MUSICAL PERFORMANCE

LATHES for the Tool Room-Manufacturing-Machine Shop-Repair Shop-Service Station

New Model South Bend Back-Geared Screw Cutting Precision Lathes

Built in the same plant where 40,000 other fine South Bend Precision Lathes have been manufactured for the United States Government, Ford, Westinghouse, Bethlehem Steel Company, U. S. Steel Corporation and hundreds of other large industries in the United States and 78 Foreign Countries.

Easy Payments If Desired

A small down payment brings you the Lathe to use while you are paying for it. We ship immediately upon receipt of the down payment.

9" x 3' Junior Back Geared Screw Cutting Bench Lathe **$150**

11" x 4' Quick Change Gear Lathe, Straight Bed **$335**

13" x 6' Quick Change Gear Motor Driven Lathe **$908**

Brake Drum Lathe

Handles all Brake Drum work without removing Axle

No. 1 Lathe. Wheels to 32" dia.	$475
No. 2 Lathe. Wheels to 36" dia.	550
No. 3 Lathe. Wheels to 42" dia.	1400

16" x 6' New Model South Bend Quick Change Gear, Back Geared Screw Cutting Lathe **$540**

Other Popular Selling Sizes

The Prices of Popular Selling Sizes with Countershaft and Equipment

Size of Lathe	Shipping Wgt.	Standard Change Gear	Quick Change Gear
9" x 3'	400 lbs.	$235.00	$270.00
11" x 4'	725 lbs.	300.00	335.00
13" x 5'	1110 lbs.	352.00	402.00
15" x 6'	1550 lbs.	430.00	490.00
16" x 8'	2005 lbs.	510.00	570.00

Also Made in Silent Chain Motor Drive

Used By America's Largest Industrial Plants

The best proof of the quality and accuracy of South Bend Lathes is that they are used in production tool room work and in general machine work by America's largest industrial plants. For Example, General Electric Co., Western Electric Co., Packard Motor Co., Oldsmobile Co., Houdaille Engineering Co., Victor Talking Machine Co., Black & Decker Mfg. Co., International Harvester Co., and in many departments of the United States Government.

Free—Write for No. 89-A Catalog

describing 57 sizes and types of New Model South Bend Lathes. Check off in the squares below, indicating Lathes in which you are interested.

- ☐ 9" Junior Lathe
- ☐ 11" Lathe
- ☐ 13" Lathe
- ☐ 16" Lathe
- ☐ 18" Lathe
- ☐ New Gen'l Catalog No. 89-A
- ☐ "How to Run a Lathe." 25c
- ☐ Auto Mechanics' Service Book. 25c
- ☐ Brake Drum Lathe Circular

SOUTH BEND LATHE WORKS

Main Office and Works

853 E. Madison St., South Bend, Ind., U. S. A.

New York City, J. H. BIGGS CO., 181 Centre St.

Carried in Stock by Machinery Supply Dealers in Principal Cities Throughout the World.

Neat, Inconspicuous Fire Screen Built at Small Cost

By HI SIBLEY

The screen covers the fireplace completely and the framework is shielded from the heat

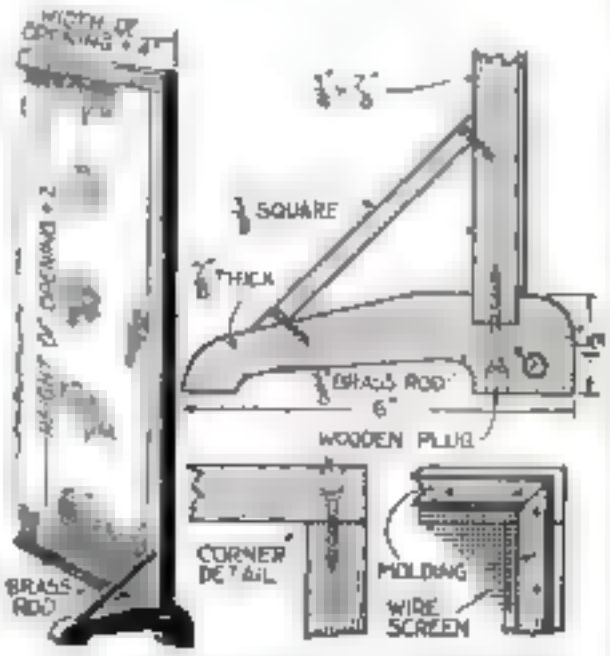
THIS effective fire screen will appeal to those who prefer simplicity to ornateness. In fact, one doesn't realize there is a screen in front of the fire at all, yet it completely covers the fireplace opening.

The construction requires only an hour or two, and the original screen cost the writer exactly fifty-eight cents for materials.

Select your wood with a view to its beautiful grain. Be sure that all ends are absolutely square, otherwise your screen will not stand flat against the fireplace. Draw the screws up tight, sandpaper and apply an oil stain, wiping it smooth with a cloth. The stain should be darker than the fireplace opening.

When dry, attach the screening in the usual manner and bind it with half-round molding as on a window screen. You will find ordinary galvanized window screening less conspicuous than copper or black. The lower edges should be bent around the brass rod and fixed in place with wire taken from the screen used.

Note that, unlike most commercial screens, this will not fold up unexpectedly, will not tip over, and does not permit sparks to fly over the top. It is designed to stand close to the fireplace opening, but the wood frame is not exposed to the direct heat.



One end of the assembled screen and details of the supports, corner joints, and molding.

COMBINATION SET OF 3 GAUGES

4" Depth Gauge, 3" Bevel Square and Center Gauge. Every Mechanic or Apprentice needs them daily.

All 3 For $1.45 Postpaid

Hetherington Mfg. Co.
4526 Cahuenga St. Los Angeles, Calif.

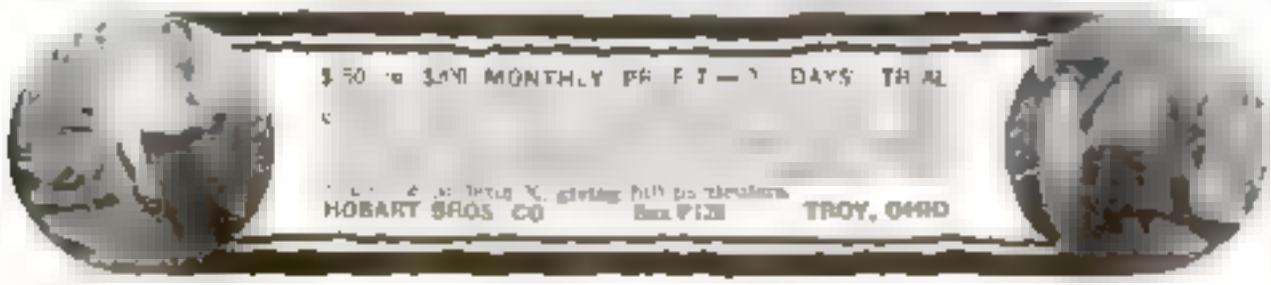
Practical, Desirable **CHRISTMAS GIFTS!**

Gardner **TOOL CHESTS**

are Ideal. Let our catalog and prices help you.

A postal brings it.

H. GERSTNER & SONS
568 Columbia St. Dayton, O.



This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

FACTORY TO YOU—SAVE 50%—COMPARE WITH COSTLIEST OUTFITS BEFORE YOU BUY

Enjoy a powerful new Miraco AC Electric or Battery

set or complete outfit

30 DAYS FREE

3 Year Guarantee

Get Our Send No Money 9th Anniversary Offer!

Values Unsurpassed in the Radio Field

The Latest Finest and Costliest Construction

$49.88 COMPLETELY ASSEMBLED

8 tube one dial Electric Lighted

MIRACO

CATHEDRAL TONED, SUPER SELECTIVE, POWERFUL DISTANCE GETTERS

Celebrating its 9th successful year, America's big, old, reliable Radio Corporation springs a genuine sensation in high-grade sets. With its latest, Super-powered, 1-dial Miracos—the All Electric wholly self-contained, hum-free, AC-8 and AC-9, using AC tubes or the new 8-tube models for batteries or Eliminators—you are guaranteed values and savings unsurpassed in the fine set field.

Compare a Miraco with highest-priced radios, for 30 days in your home. Surprise and entertain your friends—get *their* opinions. Unless 100% delighted, *don't buy it!* Return everything—*the complete outfit*—at our expense. Your decision is final—absolutely!

Only exceptionally fine radios, of the very latest approved type, at rock-bottom prices, could possibly back up so liberally unconditional a guarantee. Send coupon now for *Amazing Special Factory Offer!*

Don't Confuse with Cheap Radios

With its rich, clear Cathedral tone, hum-free operation, tremendous "kick" on distant stations and razor-edge selectivity—with its costly sturdy construction, latest features, including phonograph pick-up connection, ease of tuning, beauty, and economy—a Miraco will make you the envy of many whose radios cost 2 to 3 times as much!

Many thousands of Miracos—bought after 30 day home comparisons—are cutting through locals and getting coast to coast with the tone and power of costly sets, their delighted users report. Miracos are laboratory-built with finest parts, and embody 9 years' actual experience in constructing fine sets. Approved by Radio's highest authorities.

Deal Direct with Big Factory

Everything reaches you splendidly packed and ready to install to assure your instant enthusiasm. Enjoy the outfit 30 days—then decide. Liberal 3-year guarantee on each set. Play safe, save lots of money, and secure satisfaction by dealing direct with Radio's old reliable builders of fine sets—9th successful year.

Miraco Outperforms 'em All in Chicago

On the Miraco I can get stations in all my up-to-date Atlantic coast to coast broadcasts. I am in the Gulf of Mexico and I can get as much distance and tone. I am an outside aerial 150 feet, an inside aerial 20 feet, and light socket. I want to say that your set does outperform the other sets I have. I put it up against a World Record Super 9 and beat that one. Then I put it up against a (name expensive make) and beat that one. Next I put it up against a Neutrodyne and beat that one. HARRY EOFF, 6555 South Peoria Street, Chicago, Illinois.

AC-8—$71.50

Unbeatable value in a 3-year guaranteed super Miraco. All-electric.

Also New, More Powerful Battery Sets

The newest and latest in battery operated sets, designed with same advanced features used in electric sets. Same wide choice of cabinets. High-quality, amazingly low-priced.

BIG DISCOUNTS
Exclusive Territory to User-Agents on
BATTERY OR AC ELECTRIC OUTFITS

NEW LOW FACTORY PRICES
SAVE 50%
Wide Selection of Beautiful Cabinets
AC or Battery Sets
30 DAYS HOME TRIAL

Mail for newest compact [illegible] Miraco Power [illegible]

Dealers Write!

Free!

MIDWEST RADIO CORPORATION, 406RD Miraco Building, Cincinnati, Ohio

BEAUTIFULLY ILLUSTRATED CATALOG, AMAZING SPECIAL FACTORY OFFER, TESTIMONY OF NEARBY USERS—Ask for proof you want of our honesty, fairness, also financial integrity, radio experience and the performance of our sets—including Amazing Factory Offer—sent with catalog.

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets—9th Successful Year
406RD Miraco Bldg., Cincinnati, Ohio

THIS COUPON IS NOT AN ORDER

WITHOUT OBLIGATION, send free catalog, Amazing Special Factory Offer, testimony of nearby users, etc. ☐ User ☐ Agent ☐ Dealer

☐ Check here if interested in an EXCLUSIVE TERRITORY PROPOSITION

NAME ADDRESS

Give Him a Good Set of Tools

A hammer, saw, plane, brace and bits, screw driver and, of course, Nicholson Files including—

A Nicholson Flat Bastard for metal surfaces — a Mill Bastard File for finishing work — and a Slim Taper File for sharpening the saw.

Any man or boy can find jobs in "dozen lots" to be done with Nicholson Files. Experience will teach him the value of these sharp cutting, durable tools.

At hardware and mill supply dealers'

NICHOLSON U.S.A. (TRADE MARK)

A File for Every Purpose

NICHOLSON FILE CO.

Providence, R. I., U. S. A.

Blueprints for Your Home Workshop

OUR blueprints can be obtained for 25 cents a sheet. In some cases there are two or three sheets to one subject. The blueprints are complete in themselves, but if you wish the corresponding back issue of the magazine in which the project was described in detail, it can be had for 25 cents additional so long as copies are available. Other subjects besides those below are to be had; send a stamped envelope for the complete list.

Popular Science Monthly,
250 Fourth Avenue, New York

Send me the blueprint, or blueprints, I have underlined below, for which I inclose ..... dollars..... cents

No.	Title	Described in Issue of		Price
1.	Sewing Table	Feb.,	'21	25c
2.	Smoking Cabinet	*Mar.,	'22	25c
3.	Kitchen Cabinet	*May,	'22	25c
15.	Workshop Bench	Jan.,	'23	25c
21	Colonial Desk	*Apr.,	'23	25c
25.	One Car Garage	*May,	'23	25c
27	Kitchen-Cabinet Table	Oct.,	'23	25c
30.	Tea Cabinet, etc.	Jan.,	'24	25c
31	Sewing Cabinets	Feb.,	'24	25c
37.	Simplified Bookcase	Dec.,	'24	25c
39.	Salem Chest of Drawers	*Feb.,	'25	25c
43	Four Tube Receiver	*July,	'25	25c
44-45	Pirate Ship Model	*Feb.,	'26	50c
46-47	Galleon Ship Model	May,	'26	50c
48.	Sailing Yacht Model	*July,	'26	25c
49.	Broom Cabinet	Aug.,	'26	25c
50.	Airplane Model (Rise-off-ground tractor. 36 in.)	*Sept.,	'26	25c
51-52-53.	Clipper Model *Sovereign of the Seas*	*Oct.,	'26	75c
54.	Five Tube Radio Set	*Oct.,	'26	25c
55.	Five Tube Set Details	*Oct.,	'26	25c
56	Bird and Animal Toys	Dec.,	'26	25c
57-58-59.	Constitution Ship Model 'Old Ironsides')	Jan.,	'27	75c
60.	Welsh Dresser	Mar.,	'27	25c
61.	Viking Ship Model—Hull	Apr.,	'27	25c
62.	Viking Ship Details	Apr.,	'27	25c
63-64	Toy Motor Boat. 39 in. long hull	May,	'27	50c
65	Six Simple Block Puzzles	June,	'27	25c
66.	Ship-Model Weather Vane	Aug.,	'27	25c
67.	Toy Model of Lindbergh's New York-to-Paris Plane	Aug.,	'27	25c
68.	Magazine Rack Table and Book Trough Table	Sept.,	'27	25c
69.	Flying Model 3 ft. of Lindbergh's Monoplane	*Oct.,	'27	25c
70	Console Radio Cabinet	Nov.,	'27	25c
71	Console Cabinet Details	Nov.,	'27	25c
72.	Doll's House	Dec.,	'27	25c
73	Doll's House Furniture	Dec.,	'27	25c
74-75-76.	*Santa Maria* Ship Model, 18 in. long hull	Dec.,	'27	75c
77	Simple Pier Cabinet and Decorative Wall Shelves	Jan.,	'28	25c
78.	Simple Treasure Chests	Feb.,	'28	25c
79	Electric Radio Set	Feb.,	'28	25c
80.	High Power Unit for Electric Radio Set	Mar.,	'28	25c
81.	Low Power Unit for Electric Radio Set	*Apr.,	'28	25c
82.	Simple Single-Stick Airplane Model 30-in.	Mar.,	'28	25c
83-84-85.	*May flower* Model	Apr.,	'28	75c
86.	Racing Airplane Model 35 in. twin pusher type	May,	'28	25c
87	Seaplane Model 30-in.	June,	'28	25c
88.	Simple Modernistic Stand; Modernist Bookcase	Aug.,	'28	25c
89-90	*Bremen* Scale Flying Model 3 ft.	Aug.,	'28	50c
91	Modern Folding Screens	Sept.,	'28	25c
92	Simple Baltimore Clipper Ship Model (8 in. long)	Sept.,	'28	25c
93	Three Modern Lamps	Oct.,	'28	25c
94-95-96.	Mississippi Steamboat Model	Nov	'28	75c
97.	Modern Radio Set in One-Tube Form	Nov.,	'28	25c
98.	Modern Radio Set in Two-Tube Form	Dec.,	'28	25c
100.	Modernistic Book Ends. Book Shelf Low Stand	Dec	'28	25c
101.	Toy Fire Engine Sprinkler Truck, Tractor	Dec	'28	25c

*Magazine only out of print.

Name
(Please print name and address very clearly)

Street

City and State

This is the Medium Size Eveready Layerbilt "B" Battery No. 485. 2¾ inches thick. 45 volts, $2.95.

$2.95 costs you only 20¢ more

If you use the medium size, you can buy the Eveready Medium Size "B" Battery No. 772, for $2.75. It's a fine battery of its type—cylindrical cell. BUT, just add 20 cents to your price, and get the Eveready *Layerbilt* Medium Size "B" Battery No. 485. Same outside size as the older battery, but more active materials inside, and so you buy 25% longer life with your 20 extra cents. Another great battery bargain!

Both these Eveready Layerbilts are made of flat cells that fill all available space inside the battery case. This construction avoids the useless waste spaces between the cells of the older, cylindrical cell type of battery, and eliminates soldered connections between cells. The truly modern "B" battery is the Eveready Layerbilt. These two batteries, exclusive with Eveready, are longer lasting and more economical. Look for the name Layerbilt on the label.

NATIONAL CARBON COMPANY, INC.
New York UCC San Francisco
Unit of Union Carbide and Carbon Corporation

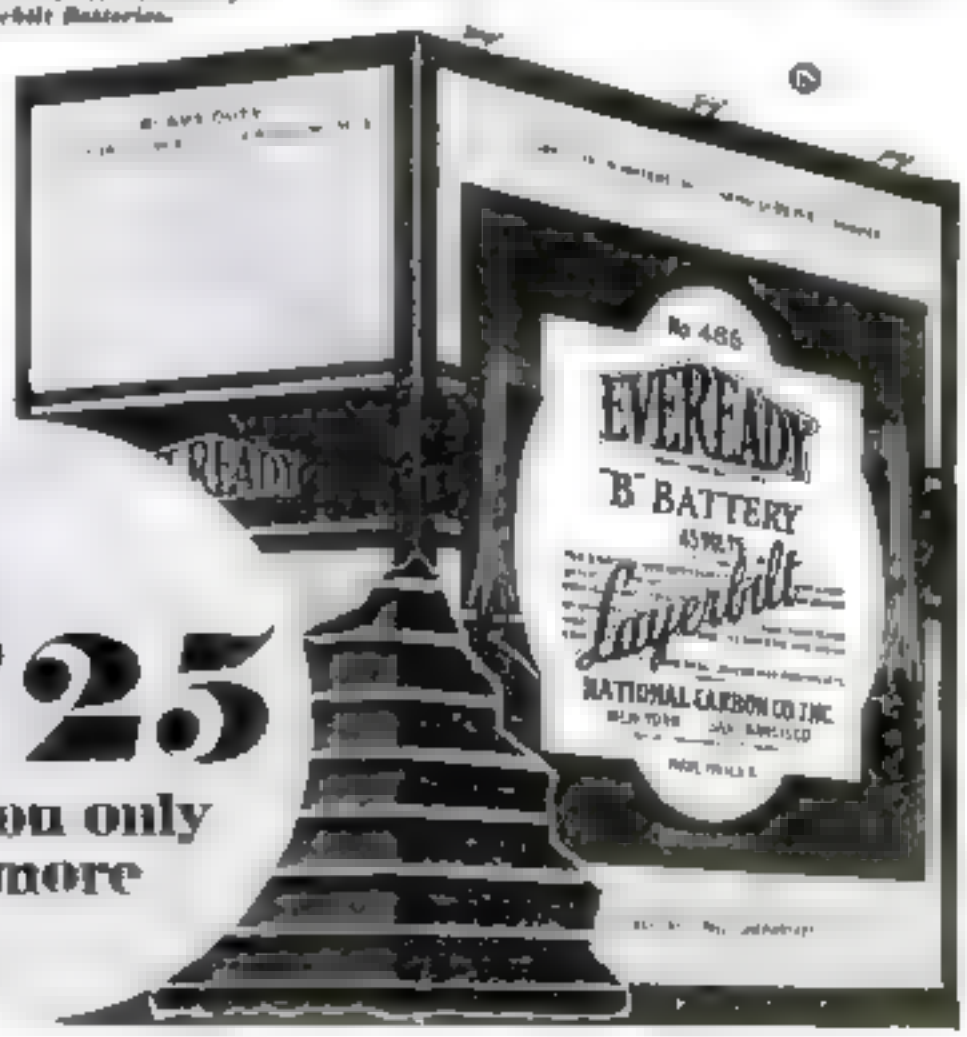
Never was so much extra service bought for so few extra cents

EVEREADY
Radio Batteries

Layerbilt construction is a patented Eveready feature. Only Eveready makes Layerbilt Batteries.

TUESDAY NIGHT
IS EVEREADY HOUR NIGHT

East of the Rockies, 9 P. M. Eastern Standard Time, through WEAF and associated N. B. C. stations. *On the Pacific Coast*, 8 P. M. Pacific Standard Time, through N. B. C. Pacific Coast network.



$4.25 costs you only 25¢ more

YOU are a "B" battery user. You are most probably interested in one of two popular sizes. You use, in the majority of cases, either the heavy duty size, or the medium size. If you use the heavy duty "B" batteries, which is the most economical thing to do, you can get the Heavy Duty Eveready No. 770, which contains cylindrical cells, for $4.00. BUT for only 25 cents more you can have the famous Eveready *Layerbilt* No. 486, which is the same size, outside, but which contains more active materials, and lasts 30% longer. For your extra quarter you get from a quarter to nearly a third more service. Never before did 25 cents buy so much battery service!

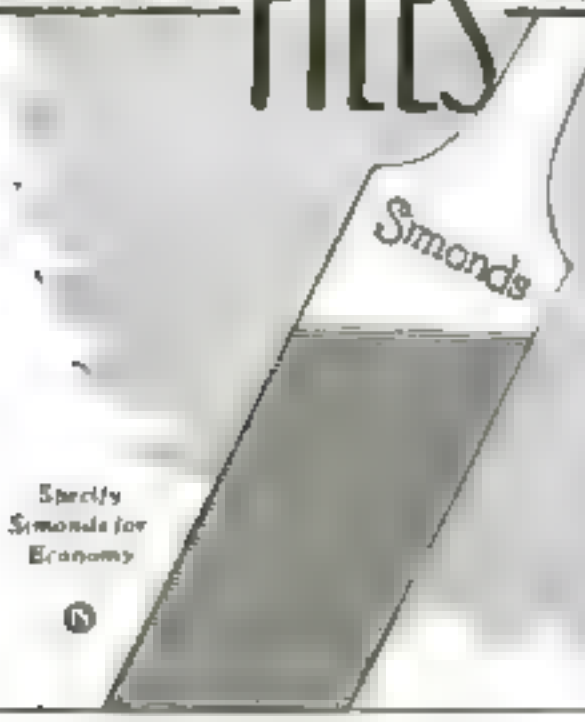
This is the famous original Eveready Layerbilt "B" Battery No. 486. The longest lasting of all Eveready's. 4 7/16 inches thick. 45 volts, $4.25.

SEE AND HEAR THE NEW EVEREADY RADIO SETS

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

SIMONDS

SAWS FILES KNIVES STEEL



Specify Simonds for Economy

CUT EASIER WEAR LONGER

In industrial plants, where every cost factor is vigilantly watched, Simonds files are always found at work. They save valuable hours of working time because their accurately cut teeth do their work faster. They save worthwhile dollars of tool expense because their tough teeth last longer in hard use. Send for copy of booklet, "File Facts," FREE.

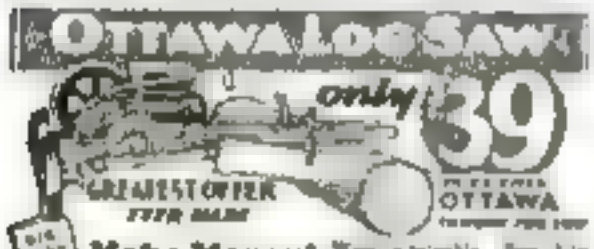
SIMONDS SAW AND STEEL COMPANY

"The Saw Makers" Fitchburg, Mass.

BRANCH OFFICES AND SERVICE SHOPS IN PRINCIPAL CITIES

OTTAWA LOG SAWS

only $39



GREATSTOWER TYPE SAW

OTTAWA

Make Money!

30 DAYS TRIAL

OTTAWA MFG. CO., 1881-W Wood Street, Ottawa, Kansas

ZIP-ZIP SHOOTER

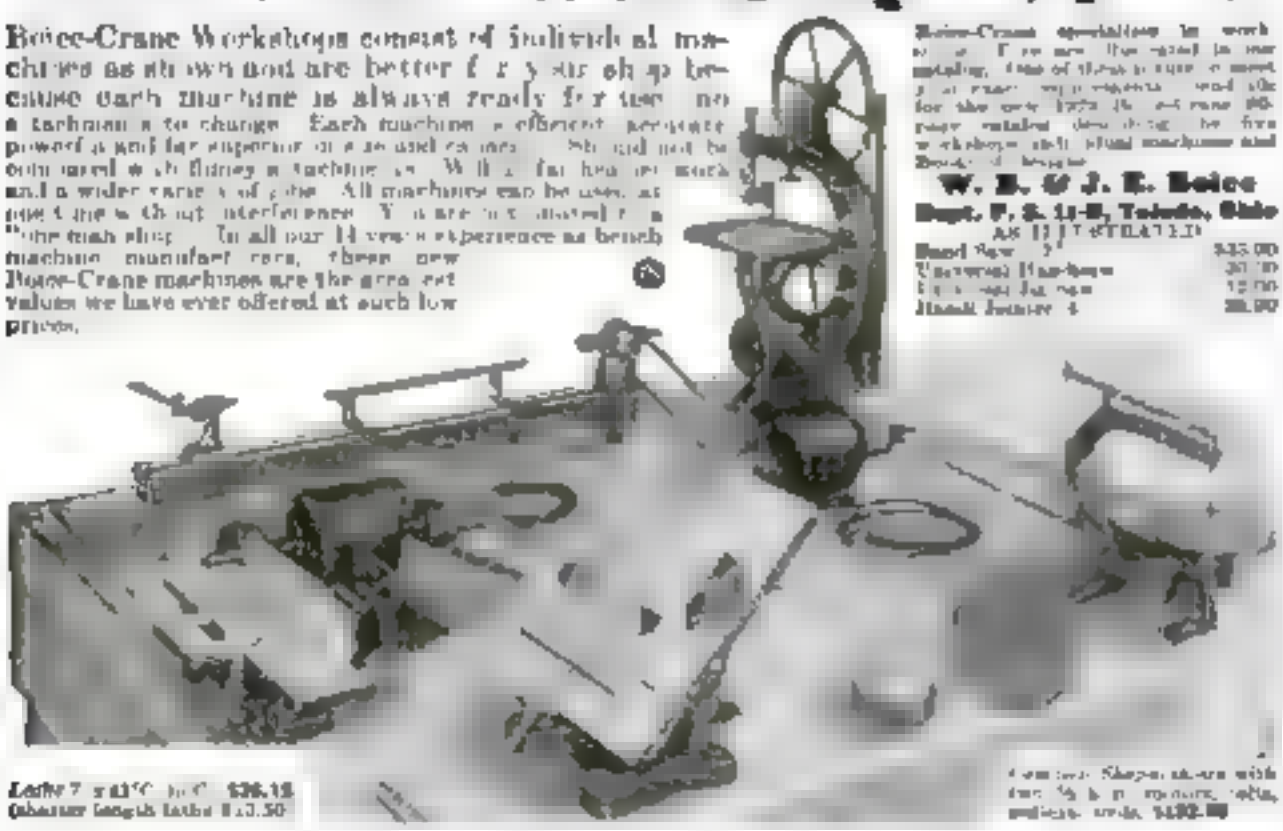
LET'S GO, BOYS:

AUTOMATIC SHOOTER CO., Dept. E E, Cincinnati, O.

A definite program for getting ahead financially will be found on page four of this issue

Boice-Crane Workshops $48 and Up!

Boice-Crane Workshops consist of individual machines as they would not be better for any shop because each machine is always ready for use—no attachments to change. Each machine is efficient, portable, powered and self-contained. Should not be confused with flimsy machines. With far heavier work and a wider variety of jobs. All machines can be used at one time without interference. You are not limited to a "one man shop." In all our 14 years experience as bench machine manufacturers, these new Boice-Crane machines are the greatest values we have ever offered at such low prices.



Boice-Crane specialists in work of this kind. If you have [illegible] metal working, one of these machines will [illegible] for the work. Write for our new 96-page catalog describing the five Boice-Crane bench machines and Boice-Crane lathes.

W. B. & J. E. Boice

Dept. P. S. 11-B, Toledo, Ohio

AS ILLUSTRATED

Bench Saw	$45.00
Universal Hardware	30.00
[illegible]	12.00
Bench Jointer	38.00

Lathe 7 x 42" [illegible] $36.15
Shorter length lathe $33.50

Combination Shaper-Mortiser with [illegible] $192.00

Old Bill *Says*—

THE worker who spends the most time studying his drawings generally turns out the best work in the shortest time.

It's no use! Some old-timers still insist on taking half an hour or more to file an arbor to size, when it could be ground in five minutes. Then it would at least be round!

Old Bill, genial machine shop foreman.

A mixture of gasoline and vaseline is a good antirust coating for tools or polished metal machine parts.

Worn centers on a lathe, milling machine, or grinder are always a source of trouble. Grind them once a week if necessary.

A machine shop is like a tailor shop in one respect: there are always enough misfits.

We are living in an age of specialists. Pick out your bright spot, and keep on polishing.

The man who boasts he never "wings"—spoils—a job is right. He's generally out of a job.

It is advisable to soft-grind all cylindrical parts to be casehardened.

A good electric soldering iron is a fine addition to any toolmaker's kit.

Before starting to mill a piece of cast iron, it will help materially if you grind off the scale, even if you have to make use of a portable electric grinder to do it.

Vise Jaws Serve for Bending Small Duplicate Parts

BENDING operations can be done with a bench vise when only small lots are required and the expense of making dies is not warranted, or in small jobbing shops where better facilities are not available. Auxiliary vise jaws are made for bending the piece and are substituted for the regular vise jaws. They may be made of tool or machine steel, depending upon the character of the work.

Auxiliary bending jaws fitted to vise.

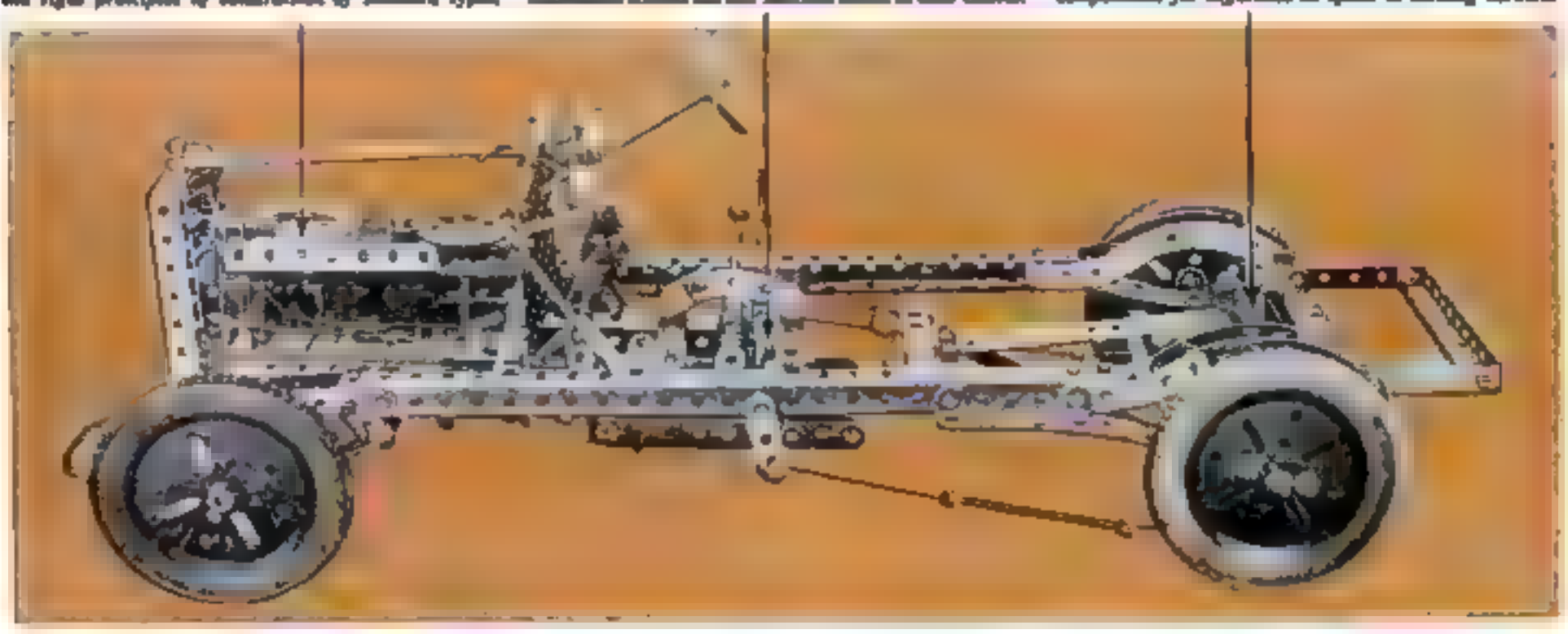
Many intricate bends can be made in sheet metal. Holes can be punched where they are needed by adding punches to the dies. While this method is slow, it is economical in many cases when exact duplicates are required of pieces such as the one shown.—H. L. Wheeler.

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

The Meccano patented two-way electric motor is a remarkable piece of workmanship because it embodies all the rigid principles of construction of standard types.

This transmission gear assembly gives a splendid, clear idea just how those gears work. Several prominent automobile schools use this Meccano model in their classes.

The differential gear is a device which transmits the power evenly to the road wheels and at the same time compensates for difference in speed in turning corners.



GIANT BLOCK SETTING CRANE

In harbor construction work great steel cranes are used to place 200-ton concrete blocks in position on the sea bed. All these operations are reproduced in miniature by this Meccano crane operated by the two-way electric motor.

606 Models and a Two-Way Electric Motor to Run Them for $5.00

Shown above is the famous No. 1X Meccano outfit which contains hundreds of precision parts; four big swivel base wheels, braced girders, plates, trunnions and a complete book of instructions.

The magnificent 2X special Leader Set that all the boys are talking about builds 734 special models and has the exclusive Meccano reversing electric motor. It contains a set of four solid massive tread tires giving the last word in realism. This set costs $10.00 and is packed in a fine wood cabinet.

Get Your Meccano Set Today and Join the Experts.

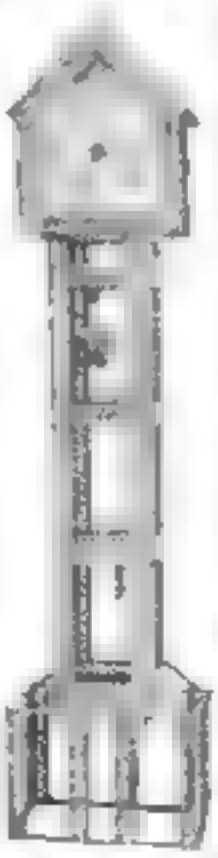
Makes MOST... BIGGEST... *and* BEST MODELS

Construction parts that satisfy the expert

THE U. S. War Department would never have approved the construction of the New Perth Amboy (New Jersey) projected suspension bridge if they had not been able to examine a scale replica of it made with Meccano. Meccano is the equipment that graduate engineers and architects employ to make their scale models; it is the choice of the experts, and if you wish to build models for real fun, or for profit — as *they* do — you must join the experts.

Cast your expert eye over this automobile chassis shown above. Here are only a few of its specifications: geared transmission operating three speeds forward and reverse; positive differential gear; Ackerman improved steering; friction clutch; torque rods; foot brake on cardan shaft; internal expanding brakes; radiator fan; semi-elliptic laminated springs; disc wheels; Dunlop tires.

Junior engineers the world over prefer Meccano in the ratio of one thousand to one. Meccano's popularity is no accident, but founded on solid worth. Make this test yourself. Compare Meccano's flat steel strips and girders with any others on the market. Note particularly the equidistant holes set one half inch apart and micrometer tested to the 1/1000th part of an inch.



Whether you purchase a small Meccano set for a dollar or a *de luxe* outfit for $17.50 only one quality is used throughout —the best.

A new leaflet containing detailed instructions how to make the motorcar illustrated above—easily understood diagrams and clear directions make it possible for you to build your own car from radiator to rear axle housing—as well as countless other models just as interesting, is free for the asking. Just drop a penny postcard with your own name and address to Meccano Co., Inc., Div. K, Elizabeth, N. J. *In Canada:* 45 Colborne St., Toronto.

Over 43,000 hours this famous clock made of Meccano parts has ticked away, varying not more than a few seconds a year. A booklet describing how any boy can build this clock will be sent free to all who write for it.

MECCANO

THE TOY THAT MADE ENGINEERING FAMOUS

MECHANICS LOOK UP TO THE STAR

. . . they know these blades are better . . . cut faster with less breakage and last longer.

These blades are the mechanics' preference and the STAR on a hack saw blade is your assurance of a better blade . . . a blade that has won its merits by reliability and dependable performance.

Let us send you free samples.

Clemson Brothers, Inc.

Middletown, N. Y.

MAKERS SINCE 1883

STAR HACK SAWS

Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

CHEMICALLY, soaps are the sodium, potassium, or ammonium salts of the animal or vegetable fats. In the process of manufacture glycerin is given off, and the salt of the fatty acid is the soap.

The hard soaps are made by adding a solution of lye (sodium hydroxide) to the melted fat. (The cans in which lye is sold in grocery stores usually carry directions for making soap.) The soft soap is obtained when potassium hydroxide is used in place of lye.

Soap has a number of uses in shop and laboratory. In driving screws through wood, the screw will go in much faster and easier if first rubbed with a little moist soap, which acts as a lubricant. Then, too, the soap rusts the screw slightly. As the rust tends to enlarge the screw, it makes it remain firmly fixed in the wood.

A good contact insecticide for destroying plant lice and scale insects may be

Printed matter may be transferred by treating it with soap and pressing paper on it.

made by dissolving 2 oz. of soap in a pint of water with the aid of heat. Then pour the solution into a large vessel or bottle and quickly add one quart of kerosene to the still hot soap. Shake or stir vigorously until an emulsion is formed. This is the stock solution and must be diluted. For scale insects, 1 oz. is diluted with 9 oz. of water, for plant lice with 20 oz. of water, and for other sap-sucking insects, with 15 oz. of water. Spray sufficiently to cover the plant with a film of moisture, but not to form pools.

Soap may also be used to transfer printed matter to paper. Although the results are not perfect and the printed matter is reversed, fair results are possible. Moisten the paper and rub the printed matter thoroughly with a bar of soap. Moisten a clean sheet of paper and rub it strongly down upon the soaped paper with the back of a spoon. The under surface should be hard, preferably a thick sheet of glass. E. BADE.

CASTS made of plaster of Paris can be hardened by making them in a solution made by dissolving one part of alum in six parts of hot water. A very small cast should be allowed to stay in the alum water for at least an hour and larger casts for several days or a week.

Profitable-Useful-Interesting

H&A HOME CRAFTSHOP

Make the things you've always wanted to make at home with this complete equipment of high grade hine-driven tools—useful, beautiful, salable things of wood for home, yard or garden. Handles every wood working job from the simplest repair to the cabinet work. Includes the famous H & A Wood Lathe, Rip saw, scroll saw and complete accessories. The H & A motor drives the whole outfit. PLUGS INTO THE NEAREST LIGHT SOCKET

Buy it on the H & A unit plan, if you choose—that the items you want as can afford now and add others as you need them. Use it for your own pleasure and recreation, or turn your leisure hours into cash by making things to sell.

What a Wonderful Christmas Gift!

An outfit to delight the heart of any man or boy who loves good tools. All items priced separately so you can make up your own assortment. All reasonably priced. WRITE TODAY for descriptive literature and price list.

HESTON & ANDERSON
813 Western Avenue, Fairfield, Iowa

Direct From the Maker

Sent for $

Watch Chain FREE! Pay as-you-feel plan **DOWN**

STUDEBAKER WATCH COMPANY
Dept. 7906 South Bend, Indiana

SEND FOR NEW RADIO BOOK—IT'S FREE!

New hook-ups. This book shows how to make short wave receivers and short wave adapters. How to use the new screen grid tube in D. C. and A. C. circuits. How to build power amplifiers. ABC eliminators. Up-to-the minute information on all new radio developments. It's free. Send for copy today

KARAS ELECTRIC COMPANY
4053-M-North Rockwell St., Chicago, Ill.

Name

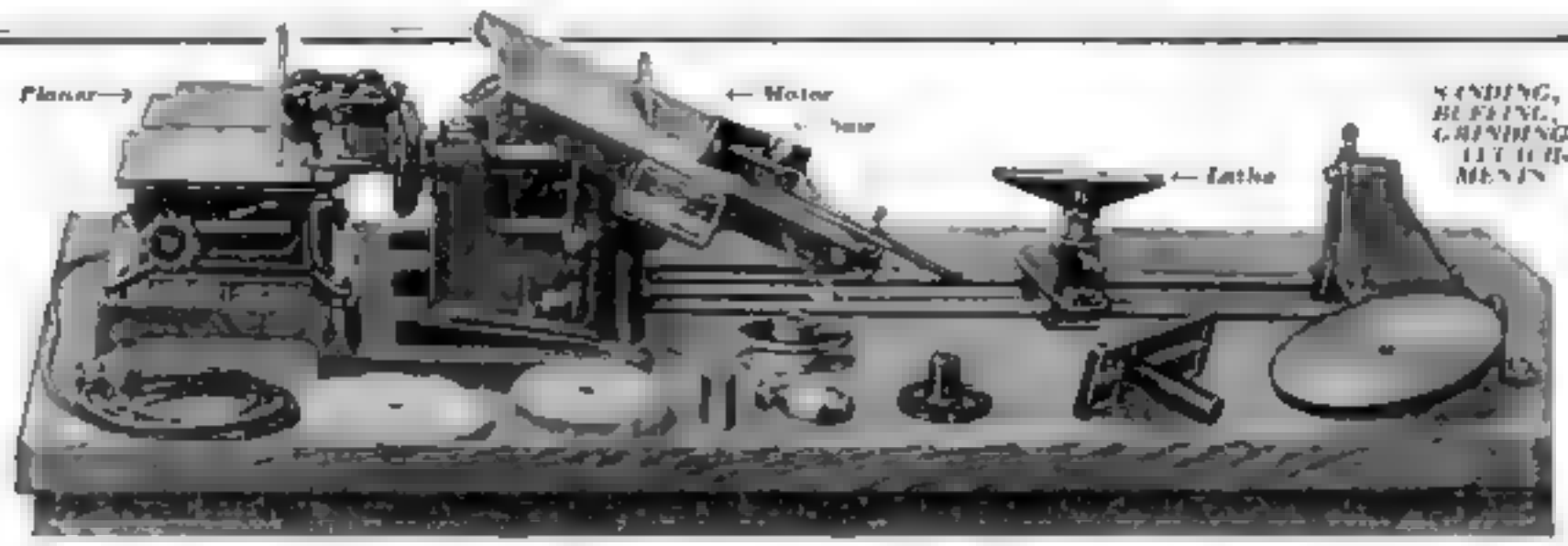
St. and No.

City and State

4053L

WORKACE Electric WOODWORKER

COMPLETE OUTFIT INCLUDING PLANER, SAW, LATHE & ELECTRIC MOTOR AND MANY USEFUL ATTACHMENTS



FAST—ACCURATE—COMPLETE

Every kind of woodworking operation

This is a COMPLETE All-Electric Shop. It costs a lot less than most other outfits—and for every dollar you pay, you're getting THE BIGGEST VALUE—you can't beat it, anywhere! You can prove every word of this by actually *using* the Workace Woodworker at home or in business. You'll find it fast and accurate—you can perform every kind of woodworking operation, make furniture or other useful and decorative things for your own home or for profit. Planing, sawing, turning, drilling, grinding, sanding or buffing—it is all the same to the Workace Woodworker. You can save time on every operation, do the work better and cleaner, too!

Amazing low price . . . . includes everything

That's because all the modern up-to-date manufacturing facilities of the J. D. Wallace Company, suppliers of standard woodworking equipment for industrial and commercial uses, are utilized to produce the Workace Woodworker. Materials and workmanship are 100% and the designing of the Workace is strictly professional. Woodworking plants, pattern shops, carpenter and cabinet shops all over the world use Wallace equipment. It's the kind of machinery you want—you can't afford to own any other.

Become an expert woodworker

There is no end to the number of useful and decorative things you can make with the Workace. Tables, chairs, footstools, screens, lamps, lattices, fences, cabinets, doll houses, bookcases, chests—you'll soon become an expert. Woodworking is the greatest hobby a man can have—hundreds turn it to profit too.

The Workace Woodworker has power, strength and capacity to handle quickly and economically any job you'll ever want to do . . . mitering, tapering, rabbeting, beveling, slotting, turning, crosscutting, ripping — anything.

$89

Includes all this:

- 4" Planer
- 8" Circular Saw
- 6" x 36" Lathe
- 8" Disc Sander
- 6" Buffing Wheel
- 5" Emery Grinder
- ¼" Drill Chuck
- ½ H. P. G. E. Motor, 110-Volt, A. C., 60 cycle

Endless V Belt, two 4" and one 2¼" V Belt Pulleys, Cast Iron Sub Base and 10 ft. Cable with separable Plug.

Every unit works from the motor. The parts are sturdy and well-fashioned. The regular Wallace UNQUALIFIED GUARANTEE assures replacement of defective parts for one year.

EASY TERMS

Get the outfit right away

SEND TODAY

The terms are all in your favor. In fact this whole advertisement. The merchandise offered and the easy method of purchasing is new and revolutionary.

A small down payment brings the complete Workace All-Electric Woodworker ready to set up and use right away. The monthly payments are so small you'll scarcely miss them. Many pay for their Workace Shop out of profits from the work it does. So can you.

Get it—use it—you'll find the Workace Electric Woodworker the best investment you ever made. Send this coupon now—today—and we'll see that you get full details and a complete description right away!

Wallace PORTABLE MACHINES

The Planer and Circular Saw are each complete units and may be purchased separately at the correspondingly low price of $35.00 each

J. D. Wallace & Co.
Wilcox St. and California Ave.,
Chicago, Illinois.

That Workace Electric Woodworker sure looks good to me. I want to know ALL about it, including your easy terms, right away.

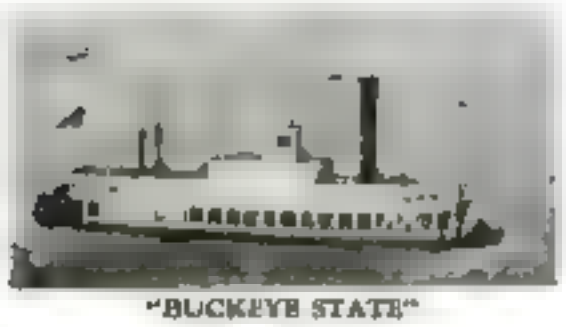
Name

Kind of Business

Address

City State

The latest thing in Ship Models



"BUCKEYE STATE"

Build This River Packet *with* Boucher Materials

There is none of the thrill of creation about making fittings that you get from shaping the hull, laying the deck and seeing the ship take form. Boucher fittings are all beautifully made of the finest quality materials. The right kind of fittings add to the beauty of the ship. Our booklet SCALE MODELS shows all kinds of Ship Model Supplies difficult to make and secure elsewhere

For the "Buckeye State"

White Pine

20x5 inches—¾ inch thick	$ .70
40x5 inches—¾ inch thick	1.40

Holly

20x5 inches—⅜ inch thick	1.40
40x5 inches—⅜ inch thick	2.80

¼ inch Bell. $ .20 ¼-in. Bks. dbl. $ .10 each
1¼-inch Capstan .50 36x¼-in. sq. Brng
¾-inch Wheel .25 .....$.10 per strip
1½-inch Blocks Glue. . . $ .15
Single $.06 each ¼-lb. ¼-in. pins. . .20

We will send any or all of this material parcel post You pay the postman the amount shown on the label and a few cents for postage If you prefer, send you remittance with your order

Other Woods

Write us if you desire some particular kind and size of wood and we will be glad to quote you a price, uncut or cut to shape

Send for Booklet "Scale Models"

This booklet SCALE MODELS has 32 pages of useful information for model makers [illegible] scale drawings, [illegible] hardware and rigging materials used in boats. Recommendations for finishing and painting model ships and hundreds of other ideas you will find useful

Whatever type of ship—sail or steam, aircraft or model—you are building or planning to build you will find the book of SCALE MODELS of tremendous help. Send 25c today for your beautifully illustrated copy. It will be sent you by return mail, postage prepaid

Gentlemen—Enclosed is 25c for which please send me immediately your 32-page illustrated booklet, SCALE MODELS.

Name.

Address.

Headquarters for Model Makers for 22 Years

Boucher Inc

415 Madison Ave. Dept. SD N. Y

How to Build a Steamboat Model

(Continued from page 8.)

How Captain McCann's model looked when carried to exactly the stage described in this article.

ends of the cylinder timbers and glued down amidships.

My original intention was to provide another room for the boilers, as shown at the right, but as this is too improbable and the boilers themselves are not much trouble to make, I discarded the inboard room and constructed them of wood, as illustrated in the photograph above and the drawing below

There were four boilers 41 in. in diameter by 28 ft., or ⅝ by 2 in. at the scale we are using. These may be four round sticks set into the fire box, but I made them in one piece with the fire box, as if they were closed beneath, thus having only to cut the top halves of them. The smoke chamber and uptake I made as a separate piece and glued onto the fore end It is a flat block widening out to the diameter of the funnels Its top is the beginning of the funnels. The centers of the projections should be the same distance apart as the funnels above—about 1⅜ in. The total height at this end must be the same as that of the engine room.

At 1¾ in forward of this I erected a cross bulkhead to come exactly to line with the cabin house above, and at about 3¼ in. abaft, another similar bulkhead These are both

The boiler assembly above which can be built up in parts or made as described in the accompanying text. How the stairs are built is shown in detail at the left.

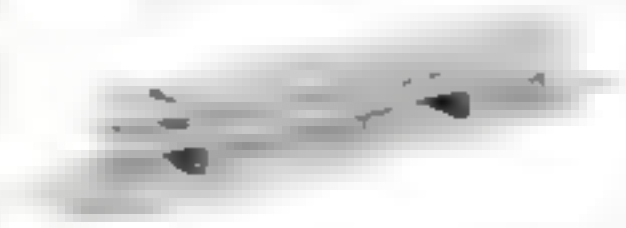
about ⅛ in. thick; they are the width of the smoke box and of the same height as the engine room.

Between the boilers and the after bulkhead, I put two piles of logs for burning. These can be either piles of little twigs or blocks of soft wood cut and stained to look like them.

Abaft this again I put a pile of casks, supposed to contain tobacco leaf they are about ⅜ in. in diameter and ⅜ in. high, stained a very light brown. In this section I also put some smaller casks (containing beer or boar's grease, according to whether the boat is going north or south) and some little rectangular blocks of wood stained and painted variously to represent cases of baggage.

Before the fore bulkhead I placed a lot of bales of cotton. These are ⅛-in. cubes of wood with the corners rounded, painted burlap color, and with some very minute tufts of cotton wool glued here and there, where the burlap has burst.

With its fore edge 9 in. from the stem, there



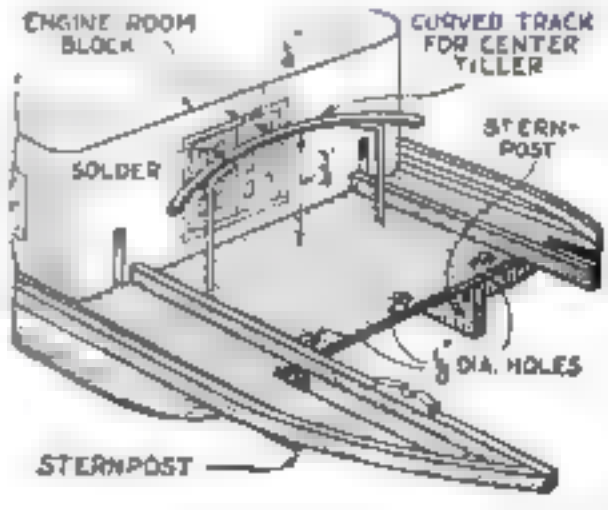
The general scheme of assembly is shown at a glance in this photograph, where the parts have been merely laid together in their correct positions. Captain McCann later substituted boilers for the solid boiler room.

should be a hatch about ⅛ in. high and ⅝ by 1⅛, painted black, with another half that size abaft the engine room

There will be a ladder from this deck to the next, amidships, just forward of the engine room. It will go up to the level of the next deck and there be cut off horizontally

The ladders for our boat can be made more easily than some for deep-sea ships because the steps will not be open at the back Make a strip of wood such as gum or holly, ⅛ in. thick by ⅛ by 11 in., for all the ladders. Now cut a piece of thin cardboard for the angle at which all the ladders are to stand, that is, about 40° from the perpendicular. With this as a guide, cut off a piece to rest on the deck and in this case to reach up to the next but in all the other cases to extend just through them. At ¼-in. intervals file or cut notches at right angles to represent the steps. Now make another strip, a scant ⅛ by a full ½ in. Glue pieces of this on either side, flush underneath.

For wooden handrails cut strips about ⅛ in. square. Bore fine (Continued on page 109)



How to make the track for the center rudder tiller and the holes for the rudder posts.

Steamboat Model

(Continued from page 108)

holes through them and also through the vertical sidepieces, and through both run ½-in. pins cut to the right length for the balusters. The end ones may have their heads left on for knobs, but those between should have the heads cut off so as not to project above the handrails.

I found, however, that a brass handrail was, if anything, rather easier to fit and better looking, even if possibly not so correct. To make these, I filed a piece of No. 20 brass wire flat on one side, soldered pins to it at the correct angle, bored the ladder to correspond, and cut off the points underneath. The pins I enameled white; the rails I polished and lacquered. Only this one ladder will be put in position now

Abaft the engine room comes the railway for the center rudder tiller to slide on. The easiest way to make this is of a curved piece of heavy wire with two uprights of the same bent over, filed thin where bent, and soldered underneath. The height of the rail from the deck is ¾ in., and the center of the curve is ½ in. from the engine room. It can be seen in the drawing on page 108.

From underneath, directly in line with the sternposts, bore 3/16-in. holes, with another in line amidships, for the rudderposts. The center one may have a little ring of wood glued to the deck above it.

This deck should now be given a thin coat of varnish wherever it shows, except for ¾ in. along the sides, where the posts supporting the next deck are to be glued. This narrow margin can be varnished from the outside after the posts are in position

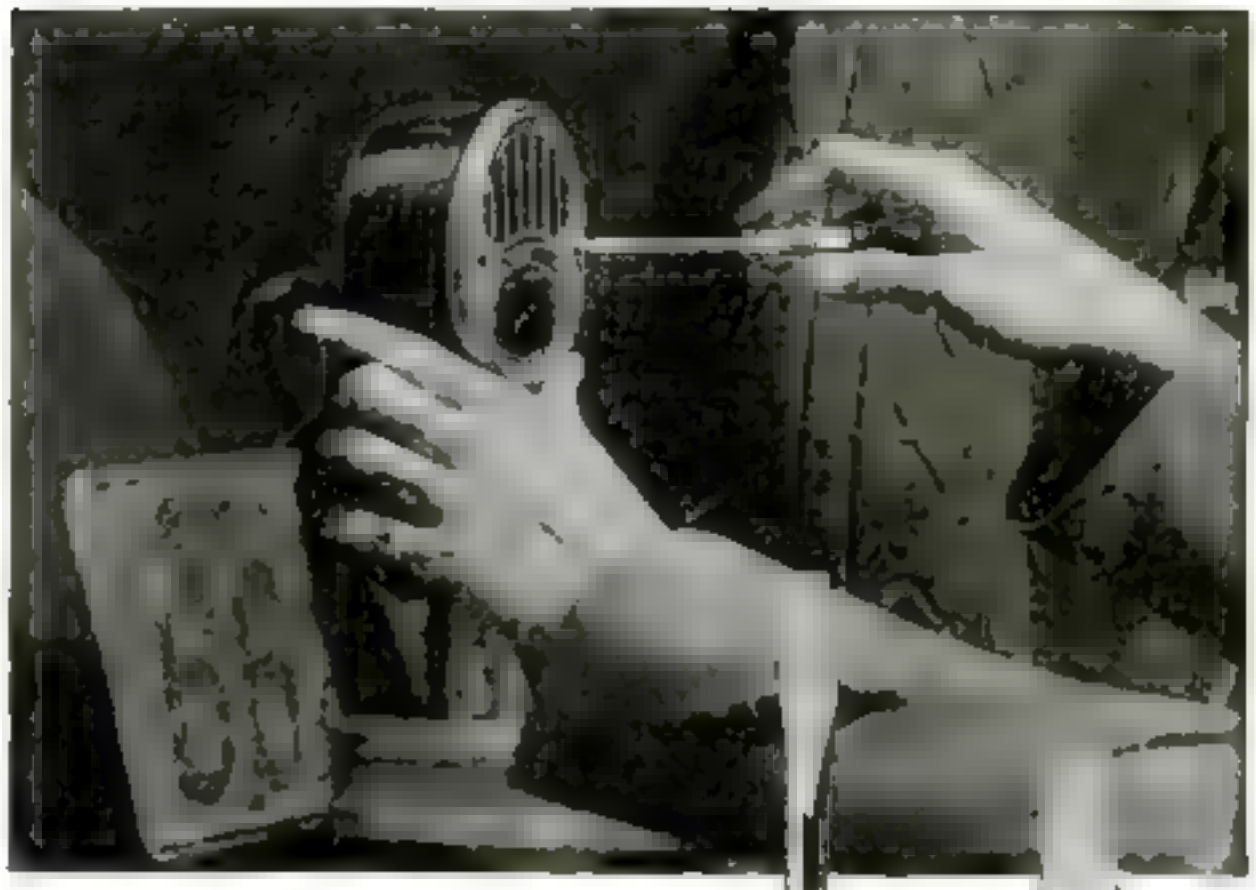
The parts of the log chains which show cannot be placed until we get the next deck on. For this we are now all ready, but will have to wait until next month to continue

Methodical Methods Save Time in Painting

ONE of the most common mistakes of amateurs in painting a wall, ceiling, or floor is to start any old place and work in all directions. Soon they find the area coated so large that they cannot keep all edges wet, and when they attempt to bring fresh paint up to half dry edges they do not get good joints. Consequently, it is best to carry the coating across the surfaces in stretches.

Stretches may be narrow or wide depending upon how fast the coating sets. With flat wall paint the stretches had best be not over eighteen inches wide, starting at the picture molding and running down to the floor. That enables the painter to get down the first stretch and start the second before the edge sets too much. The same is true of lacquer and of stains. And it is best to start next to the window wall and work away from the light as you go.—F. N. VANDERWALKER.

WHEN paint has to be left for a day or two in a bucket with no top, an effective remedy for preventing the formation of a scum and the drying out of the paint is to cover it with shellacked or oiled paper. My practice is to coat several sheets of any sort of thin paper such as pages from an old mail order catalogue, with shellac and allow them to dry. A sheet of this treated paper is carefully patted down on the top of the paint and close against the sides of the bucket. The brush, too, may be left overnight without being cleaned or placed in a liquid "keeper," if it is wrapped in another sheet. Take care to see that the brush is full of paint and the paper is folded over at the ends of the hairs to maintain a good chisel point.—GRAHAM SUCKEY



"YANKEE"
No. 15
With Thumb-turn and Ratchet

gets the best of pesky little screws. You turn blade with thumb and forefinger to start the wobbly screw, while hand steadies driver and screw. Once started, you send screw home by ratchet movement—simply turning handle to and fro.

Great time and labor savers—these "Yankee" Ratchet Screw-drivers, with right and left ratchet and rigid adjustments. This pair—No. 15 and No. 10, should be in the tool box of your car, on the bench of the garage man, in the kit of mechanic and handy man

No. 15—With thumb-turn. Blade, 3/16" diameter. Six lengths: 2", 70c; 3", 75c; 4", 80c; 5", 85c; 6", 90c; 8", 95c

No. 10—For husky screws. Eight blade lengths: 2", 65c; 3", 80c; 4", 85c; 5", 95c; 6", $1.05; 8", $1.20; 10", $1.45; 12", $1.60. Ratchet Shifter moves lengthwise

No. 11—Same as No. 10, except Ratchet Shifter moves across tool.

No screw driver is a "Yankee" Ratchet unless marked with the name

"YANKEE" on the tool you buy means utmost in quality, efficiency and durability.

WRITE us for "Yankee" Tool Book, free, showing ingenious tools that make worthwhile Christmas Gifts Ratchet Braces, Spiral Screw-drivers, Automatic Push Drills. Ratchet Hand, Breast and Chain Drills. Automatic Bench Drills. Removable-base Vises. Etc.

North Bros. Mfg. Co., Philadelphia, U. S. A.

"YANKEE" TOOLS
Make Better Mechanics

Bring the World *to* Your *Living Room*

ARM CHAIR travel, that brings vividly before you in *living* pictures, scenes and peoples from the ends of the earth! Nature and natural history pictured to the life . . . science. . .sport . . . comedies . . . "features," all this is yours to enjoy with a DeVry home movie projector

Clear, brilliant, flickerless, full-size motion pictures right in your own living room. What a wonderful gift for the family! Easy to operate; no experience required. Wide variety of subjects, on non-inflammable safety film at reasonable purchase or rental rates. Projector costs but $95

For personally made movies choose the DeVry Standard 35 mm. camera. Keep a movie diary of your travels, on shipboard, in strange lands, in the clouds —wherever you may be The DeVry enables perfect movies from the start; simply point camera and press the button. Films may be used on any standard projector. Reduction prints for 16 mm. projectors give exceptionally brilliant pictures. Camera price $150.

For free literature on home movies and complete information about DeVry superiorities write today to DeVry Corporation, Dept. 11PX, 1111 Center St., Chicago, Ill

DeVry

World's Largest Manufacturer of Standard Motion Picture Cameras and Portable Projectors

Replacing a Broken Sash Cord

Paste this Home Workshop Reference Sheet, including the head above, in your scrapbook in the section marked windows. (Dec., 1928, POPULAR SCIENCE MONTHLY.)

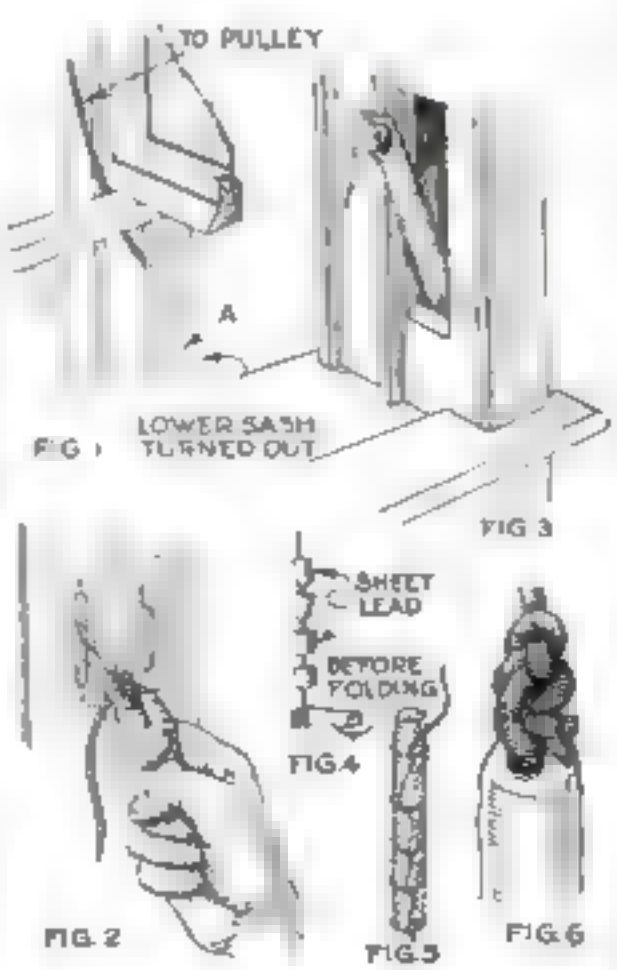
What is the quickest and easiest way to replace sash cord?

FEW defects around the house cause greater annoyance than a broken window cord. Yet, like many other things that go wrong, it may be easily remedied without calling in the aid of a mechanic, if you approach the task with confidence and have some degree of ability to use your hands. Few tools are required.

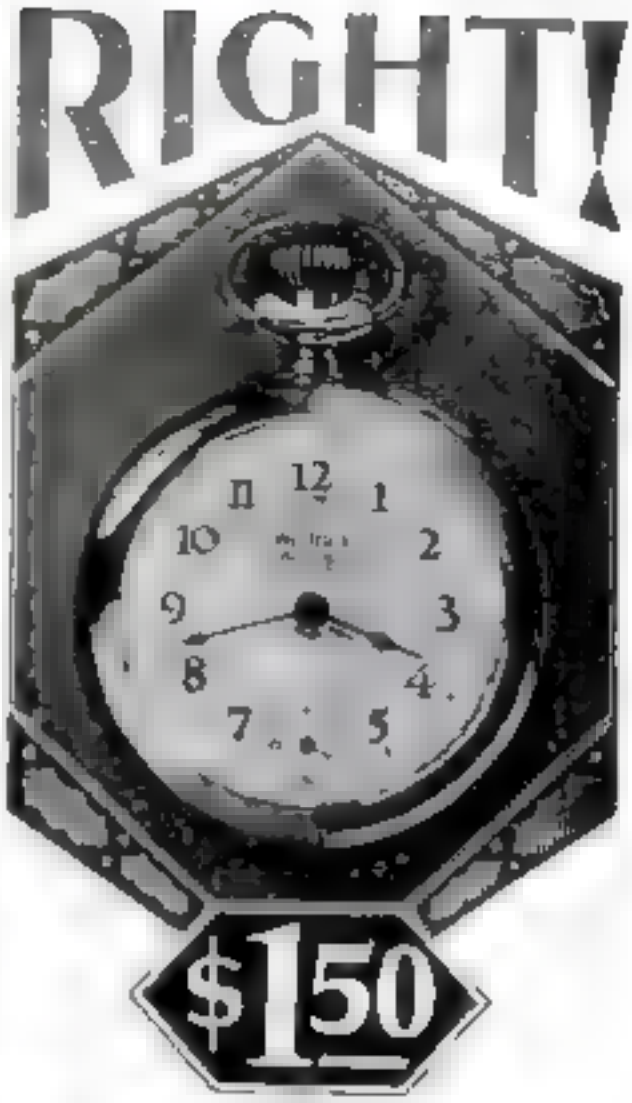
1. Inspect the cords of both upper and lower sash. If one is broken and one or more are worn and frayed, it will be an obvious economy to replace them at the same time.

2. Obtain a good grade of braided sash cord from the hardware store. It will be more economical to buy an entire hank if several cords are to be replaced, but if only one or two. You can figure roughly how much you need by allowing 5 ft. for each cord of any window of ordinary size

3. We will assume that only one cord is to be replaced and that in the lower sash, for that is more likely to give trouble. Remove the sash by the method described in a previous reference sheet (Nov., 1928). If there is a broken cord on each side, remove both stop strips, but if only on one side, the other side need not be disturbed. (Continued on page 117)



Steps in removing a broken sash cord, taking out the weight and installing a new cord.



Pocket Ben

THERE, in one word you have the real reason why Pocket Ben is in high favor with millions of men. Right —on time! A thoroughly dependable, precision-built timepiece. Neatly designed. Handsomely finished. Attractive and trustworthy.

For that boy of yours— Pocket Ben is just the gift for Christmas. Boys like what men like.

Built by the makers of Big Ben and other Westclox

WESTERN CLOCK COMPANY
La Salle, Illinois

New Auto Clock

Good looking — convenient reliable. Quickly attached to dash or above windshield of any car.

$2.50

Replacing Sash Cord

(Continued from page 110)

4. If but one cord is broken, swing that side of the sash out and place a kitchen chair, box, or other support under it. The lower sash may be pushed under one end of the upper sash to help hold it, as suggested in Fig. 1. It is, however, the best and safest practice to take the good cord out of the sash, tie a knot in it, and allow it to run up to the pulley as in Fig. 2; and then set the sash aside.

5. Remove the pocket facing; it may be necessary to take out the parting strip to do this. Lift the weight out of the pocket as in Fig. 3, cut the rope away from it, and dig out the knotted end from the sash as at *A* of Fig. 1. Observe how each of these knots is tied and fastened, for the new cord may be fastened the same way.

6. The easiest way to put the new cord through the pulley is to make a "mouse." Wrap several narrow pieces of thin sheet lead around a piece of strong, flexible line perhaps 8 ft. long, as in Fig. 4. Pound lightly, or press each piece of lead so it stays in place about as shown. A piece of chain, a heavy nail, or other light weight will answer the purpose as a makeshift. A 4-in. length of sash chain makes a particularly convenient "mouse."

7. Tie a knot near one end of the cord like Fig. 2, and tie the long end of the mouse line to the other end using half hitches as in Fig. 5. Push the mouse through the pulley from the front, allow it to drop down the pocket behind the pulley stile until it can be reached from the pocket opening. Pull out the mouse through the opening and at the same time coax the cord through the pulley from the front. Pull the cord down until the knot (Fig. 2) stops it. Remove the mouse line and tie the end of the cord to the weight with a knot that will not slip. Use the knot shown in Fig. 6, for example, or use the same knot that was on the old cord. Nearly every workman has a pet knot for this purpose, but any knot that does not allow the cord to pull directly over the axis of the weight will permit the latter to turn and swing in the pocket as it travels up or down, and perhaps make trouble with the other weight. The weights of the lower sash should swing clear of the back side of the pulley or the sash cannot be closed, though the stretch of the cord will soon make it right if not more than ½ in. has to be gained.

8. To find the length of the cord, pull the weight up until it strikes the back of the pulley. Untie the slip knot (Fig. 2) and swing the sash back again until it is as nearly as possible in place. Hold the cord against the edge of the sash and cut it off 6 inches below the hole at *A*, Fig. 1. Lay the cord in the groove, tie the knot, and push it into its hole. Drive a small nail through the knot, if necessary, to hold it there and push the sash into its place. Raise the sash, put the pocket face in its place, fasten it, and put the stop strips on.

9. It is obvious that if the upper sash is to have new cords they must be put in before those of the lower sash. In this case, remove the lower sash entirely and do not merely swing it around and attempt to hold it as suggested in operation No. 4 above. Pull the upper sash down, take out one or both parting strips, pocket facings, and weights as may be required. Put the cords in by the methods already described, being sure the cord of the upper sash is not too long or the sash may not stay up. The lower end of the weight should swing at least 3 inches above the window stool when the upper sash is in place to allow for the stretching of the cords. Replace the parting strips, pocket facings, and stops.

This is the second of a series of Home Workshop Reference Sheets which you can preserve by clipping them out and pasting them in a scrapbook under appropriate headings.

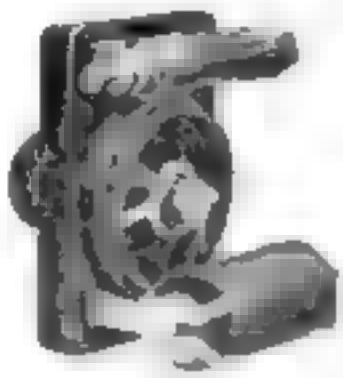
Build a Radio this Christmas —

and learn the many ways

Carborundum

REG. U. S. PAT. OFF.

will help you do it.



CARBORUNDUM DETECTOR UNIT CLARIFIES THE TONES
$3.50 IN U. S. A.

CARBORUNDUM DETECTOR
$1.50 IN U. S. A.

CARBORUNDUM GRID LEAKS, 50c.
RESISTORS
75c. and $1.00

ADD these simple efficient devices to your own home-built set. The effect is instantly apparent and out of all proportion to the modest cost.

Orchestra, band and vocal selections all will come crystal clear and undistorted from your set when you have attached the Carborundum Stabilizing Detector Unit or the Carborundum Detector. The detector is fixed permanently at the most sensitive spot. The pressure on the crystal is adjustable. It gives you pure, natural tones with volume.

Carborundum Grid Leaks are quiet. They are solid rods of Carborundum that provide uninterrupted flow of current. No noise from arcing.

No matter what you build this Christmas, you will do better work and faster work if your tools are sharp. Keep tool edges keen and cutting clean by having the Carborundum Combination Stone always handy. It is the "double-duty" homecraftsman's helper, for one side is coarse grit to take out nicks and start the edges, while other side is fine grit, for finishing.

THE CARBORUNDUM COMPANY
Niagara Falls, N. Y.

CANADIAN CARBORUNDUM CO., LTD.
Niagara Falls, Ont.

{ Carborundum is the Registered Trade Mark of The Carborundum Company for the Silicon Carbide used in the articles it produces }

"Lava-clean" hands are clean!

Men—you who love to tinker—here's just the soap you need. Cleans quickly and thoroughly the toughest-looking pair of hands that ever fussed around a work bench. Makes more lather in 15 seconds than ordinary soap in 60, and even hard or cold water won't discourage it. Millions use it. "Good old Lava" they call it. Gets hands *clean!* Not just "surface clean," but clean way down deep. As easy on your hands as fur-lined gloves—because it's made from the finest of vegetable oils. All grocers and druggists sell it.

Full size cake of Lava Soap FREE!

Mail this coupon

Procter & Gamble (Dept. X 1228)
Cincinnati, Ohio.

Please send me, FREE, a full size cake of LAVA, the hand soap that removes all the dirt and grease.

Name

Street

City

State

Build Your own BANJO CLOCK!

For Pleasure or Profit

No special ... needed. "Handy man" ... tools ... Home ... Spare ... Full-time ... which ... Clocks ... Full ... make ... and ... you have ...

Right in Your Home Workshop: Easy, Fascinating, Worthwhile Work

HERE ... Three ... complete ... parts ... Dial ... Movement ... Instructions ... Material ... Chime ... Write ... FREE BOOK ...

AMERICAN CHIME CLOCK CO.
1691 Ruffner St., Dept. P, Philadelphia, Pa.

MAIL THIS COUPON

American Chime Clock Co.
Dept. P, 1691 Ruffner St.,
Philadelphia, Pa.

Please send me FREE Book, details on Special Banjo Clock Offer and facts on how I can make Extra Money Building Clocks.

Name

Street Age

City State

This humpty dumpty toy poses grotesquely and performs clog dances.

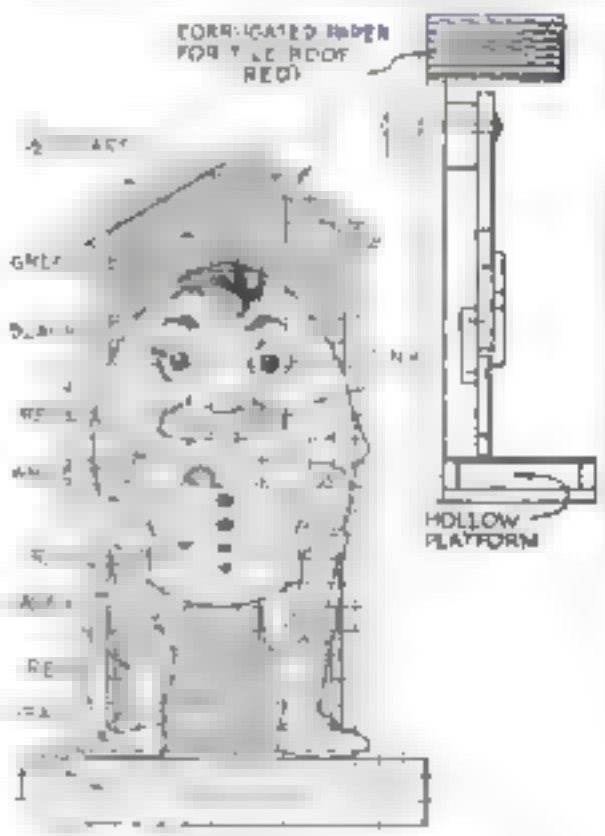
New Humpty Dumpty Dancing Toy

By Charles M. Miller

HUMPTY DUMPTY, like some other noted personages, has had a comeback and is more popular than ever. He makes an especially good toy when mounted as illustrated so that he can be made to perform clog dances.

We first must have a good outline of his comely form. The design, which follows one made by Bess Bruce Cleveland, can be enlarged by drawing ¾-in. squares on paper and copying in each square whatever appears in the corresponding square of the drawing below.

To transfer the drawing to wood, place a carbon paper between the paper and wood and trace the drawing, including the centers for the arm and leg joints. With coping or band saw cut all seven parts. File and sandpaper any places that may be rough. The two arms may be cut together and one turned over to fit the opposite side of (Continued on page 118)



Front view of the toy with squares to aid in laying it out, and a smaller side view.

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Airplane Bird Feeder Turns in the Wind

TO MAKE the airplane bird feeder illustrated, a few nails and boards, a hammer, and a saw are about the only materials and tools needed.

The feeding shelter is 11 in. wide and 23 in. long, and is 11 in. high at the open end and 6 in. at the closed end. The roof extends at least 2 in. all around and over the opening *A*, it is well to have it project 2 or 3 in. more—that is, 5 or 6 in. in all. Windows 4 by 6 or 4 by 8 in. are placed on either side.

A lag screw ¼ in. in diameter and 8 or 10 in. long passes through the 6 by 4 in.

No matter how much snow or wind there is, this revolving feeder shelters the birds.

piece *B* and is screwed securely into the 4 by 4 in. post *C*. This acts as a pin for revolving. A washer is placed under the head of the lag screw and pieces of tin where *B* and *C* join. A little oil on the tin will make the feeder turn more freely.

The tailpiece *D*, which is 28 in. long and 14 in. wide at the widest point causes the whole feeder to turn and thus keeps the birds protected from disagreeable weather at all times. The feeder should be at least 7 ft. from the ground to discourage cats.—BENNETT B. SMITH.

New Humpty Dumpty Toy

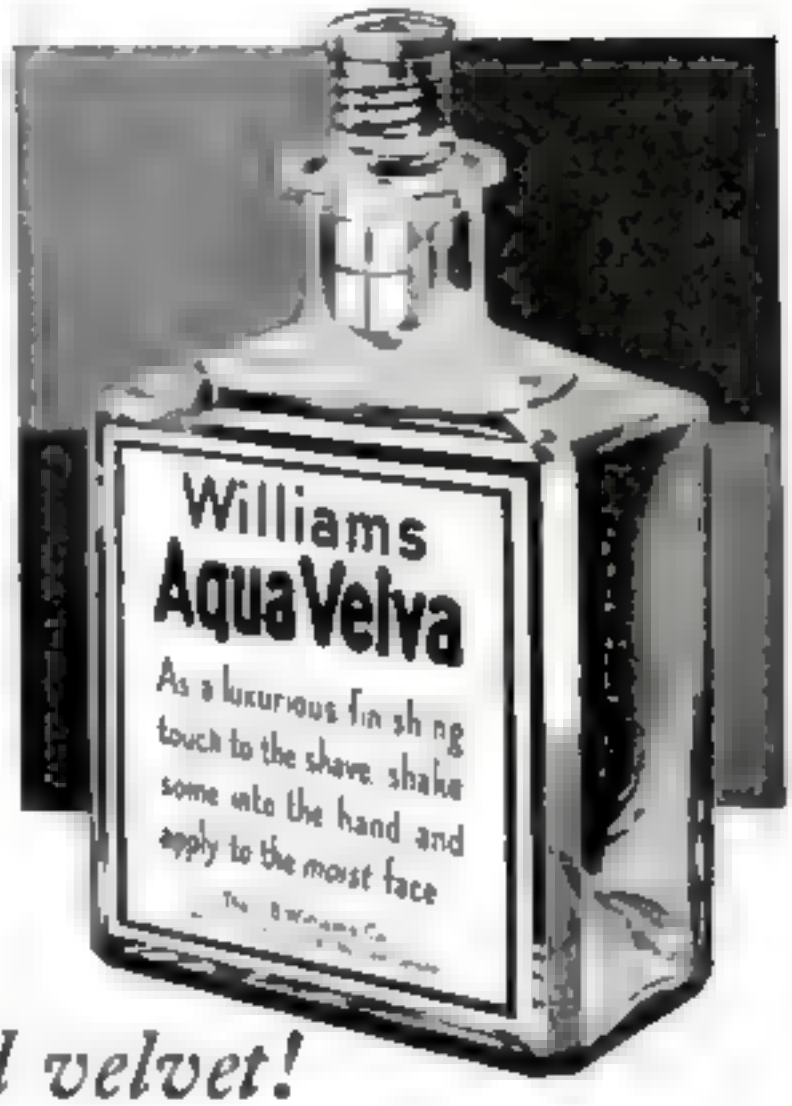
(Continued from page 112)

the body; this is true also of the legs.

Fasten the arms and the upper parts of the legs to the body with small round-headed screws. Make the holes in the front piece large enough in each case for the screws to turn freely. The total height of the figure is 10¼ in.

The action is controlled by a ¼-in. dowel that passes through the forehead to a knob device at the back of the dancing pavilion. A ¼-in. block is placed as a spacer to set the head out from the wall. A small button mold with a hole reamed to the size of the ¼ in. dowel is glued to Humpty's forehead, and the dowel stops flush with the front side of the button. For the turning knob at the back, half a good sized spool will serve, although a short length of 1-in. dowel and a 1½-in. button mold were used on the original.

The platform consists of a box 1¾ by 4 by 8½ in., made of ½-in. material with a thin toppiece. One end is left open to let out the sound of the clattering feet. The vertical wall is glued and nailed or screwed to the back of this hollow platform. Paint the toy in brilliant colors.



All velvet!

AQUA VELVA

for After-Shaving!

You'll get a stimulating thrill as you apply Aqua Velva after your shave. Your first *velvet* of the day!

Eighty-eight years of study of the needs of newly shaven faces went into the making of Aqua Velva. And today a host of discriminating men would feel lost without it.

Aqua Velva cares for tiny scrapes and cuts,—mostly unseen. Protects from wind and weather,—dryness indoors, dust outdoors. Closes pores. Conserves natural moisture, so essential to good facial condition. Made by the makers of Williams Shaving Soaps, it *keeps* the skin as the Williams lather *leaves* it, flexible and *Fit!*

Try a bottle. Note your all-day face comfort. You'll wonder how you got on so long without it.

50 cents for a 5-oz. bottle. Or a Free Trial Size if you ask for it.
Address: Dept. PS-18, The J. B. Williams Co., Glastonbury, Conn., and Montreal, Can.

Williams Aqua Velva

For use after shaving

One quality has been hammered into Billings & Spencer wrenches for three generations.

That is the quality of lifetime loyalty to the man who invests in one.

Forged with the fine zeal of masters of forge-craft. Pledged to the creed: "Our wrenches—your wrenches for life."

Make these "Lifetime Wrenches" your life partners in mechanical work. Just the set you want is waiting—

At your Dealer's.

Visitors are always welcome at the forges of

The BILLINGS & SPENCER Company
Hartford, Conn. U.S.A.

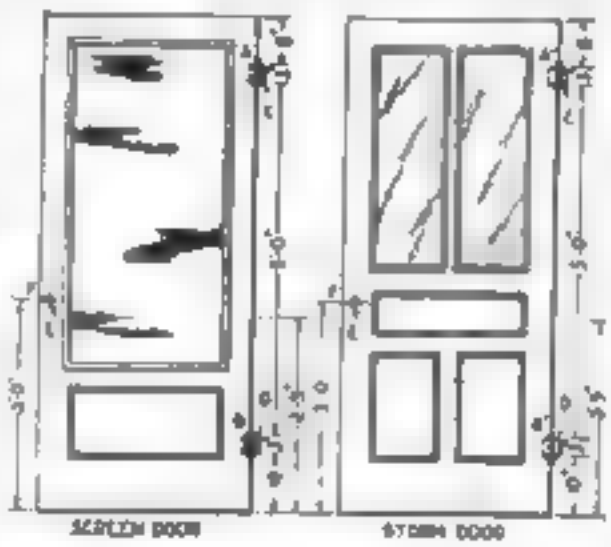
New York: 71 Murray Street
Chicago: 565 W. Washington Blvd.

Quick-Change Hinges for Storm and Screen Doors

WHEN the storm door is brought out in the fall after the screen door has been stored away, fortunate is the man who does not discover that the hinge screws are missing, or the screw holes are too large, or some extra work of fastening and fitting has to be done. But this annual annoyance can be avoided.

Whittle wooden plugs, dip them in glue, and drive them in any old screw holes which are to receive new screws so that the new screws may be driven immediately. Putty all other unsightly screw holes and small imperfections or fill them with commercial wood paste, and paint the surfaces of both door and doorframe.

Purchase two pairs of 3 by 3 in. loose-joint pin hinges and two suitable duplicate catches. Place the hinges on one door, say the screen door, as *A* and *B*. Hold the



When fitted with loose-pin hinges, a storm and screen door can be quickly interchanged.

door in its place in the opening with wedges and fasten the sides *C* and *D* of the hinges to the doorframe.

Fit a catch at *E* in the door and cut the striker plate in the doorframe at *F*. Fasten a long spiral spring to the inside of the door and to the doorframe. Remove the pin from each hinge, release the spring from the screw eye on the door, and set the door aside.

Place the parts *A*' and *B*' of the other hinge into parts *C* and *D*, which are already fastened to the doorframe, and drop the pins into the hinges. Wedge the storm door into position in the doorframe and fasten the hinge members *A*' and *B*' to it with screws. Place a catch at *E* so it exactly engages the striker in the doorframe at *F*. Turn in a screw eye on the inside of the door to receive the end of the spring.

Now, instead of spending several hours twice a year in assembling tools and accessories and in changing screen and storm doors, the head of the house simply removes the spring from the eye on the inside of the door already hung, lifts the pin from each hinge, slips the other door in position, drops the pins into their places in the hinges, and puts the end of the spring in the screw eye on the inside of the door. Fifteen minutes' work and the job is done.

The released door should be set away so it will stand perfectly straight, or it may develop a twist which will prevent it from closing properly and be impossible to remove.—C. A. K.

Do You Get $2 to $3 an Hour for Your Time?

You can easily make that much in the saw-filing business, with a Foley Automatic Saw Filer. Here are two experiences typical of the many reports in our files.

"I filed six saws in 40 minutes at 50¢ each."—Chas. E. Fuller, Luna, Ohio. "I get all the work I can handle."—H. F. Myers, Burlington, Iowa.

Get a Foley, and make money in spare time, or build up a steady year around business of your own. File saws for carpenters, contractors, schools, factories, farmers and homes.

FOLEY Automatic Saw Filer

not only files, but also brings all teeth to uniform height, spacing and size . . . automatically and with machine precision.

No experience needed. Makes saws cut better than new. More than twice as fast as hand filing. No canvassing. Write now for valuable FREE Plan on "How to Start a Saw-filing Business."

FOLEY SAW TOOL CO., INC.
1904 Foley Bldg.,
21 Main St. N.E.
Minneapolis, Minn.

Do Away with Handsanding

TAKE-ABOUT Sander

Large or small surfaces easily sanded with this little machine. Handles like a plane, leaves a flat even finish, due to the smooth action of belt. Sands five times faster than by hand. Fine for refinishing furniture, woodwork, floors, etc. Works from any light socket. No experience required to operate.

PORTER-CABLE MACHINE CO.
"Machine Tool Builders for Twenty years"
2800 Salina St. Syracuse, N. Y.

The Vest Pocket Lawyer

A complete law course—clearly analyzed in understandable English. It is a daily guide—a source of reference for the business man—the law student—the justice of the peace—the notary public—the farmer—the clergyman—the merchant—the banker—the doctor.

300 pp. Price $1.50, postpaid

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York City

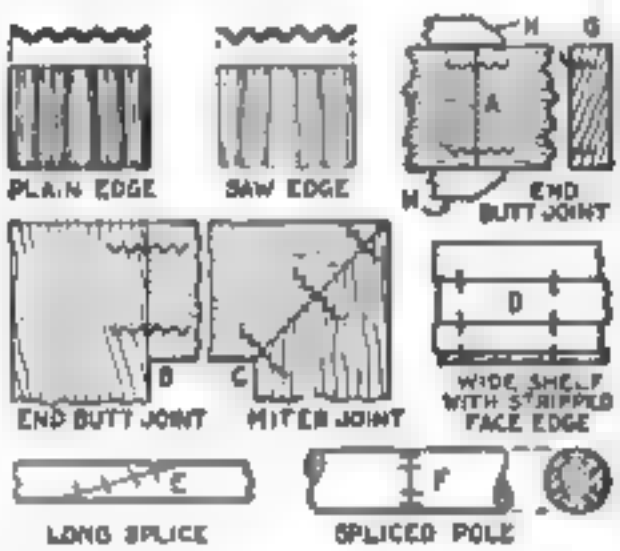
How to Make Use of Corrugated Fasteners

By DAVID WEBSTER

FEW home workers realize the advantages of corrugated fasteners for making strong joints. The fasteners are simply applied, effective, and economical. They may be obtained in most hardware stores and many ten-cent stores and are listed by large mail order houses.

Their uses are manifold: The ends of two boards may be joined as at *A*, the members of a square butted frame fastened as at *B*, and a mitered frame held as at *C*. A wide board can be made of narrow pieces as at *D*, with a strip of face wood fastened to the edge. Also, two boards may be glued and "long spliced" together as at *E*, and a pole spliced as at *F*. One reason why this method of fastening wood together is not applied more commonly is that a surface blemish results, but the fasteners may be used to advantage in many places.

The sizes of the fasteners range in length between ¾ and 1 in. by eighths



Methods of making joints with corrugated fasteners, which are hammered into the wood.

and in width from two to seven corrugations. They come in two styles of edges, plain and saw tooth. Both types are to be had with either straight or divergent corrugations. The straight are preferable if the joint is well made, but if not, the tapered fasteners will draw the joint together. The fasteners illustrated have divergent corrugations.

For ¾-in. material, ½-in. fasteners may be used as at *G*, for they will not drive through. Fit the joint and lay the pieces face down upon a bench or other smooth, firm surface. Glue each joint as it is made, if gluing is desired. Hold the pieces in perfect contact and position and drive the fasteners into the back.

If the fasteners are driven into narrow pieces parallel to the grain or too near the edge, the use of a hand screw as at *H* will guard against splitting the wood.

If the fasteners are too much in evidence, they may be driven below the surface about ⅛ in. with a nail set. Moistening the spot with a sponge will swell the wood and help in concealing the blemish. When the wood is dry, sandpaper the surface

The most modern "Personal Writing Machine"

MORE than twenty years' experience have helped to make Corona the compact, convenient portable typewriter it is today. Over a million users have proved Corona's durability. No other portable typewriter has such a record.

That is why you should have no hesitation in choosing Corona as your own Personal Writing Machine.

Corona is light, yet strength has not been sacrificed. Its tough aluminum frame has withstood unbelievable abuse.

Corona is compact, graceful in design without sacrificing completeness. The Keyboard is standard, the type-bar action is like that of a big machine. The ribbon is full twelve yards long, self-reversing. There is a real variable line spacer, back spacer, margin release—every convenience modern skill can apply to a portable typewriter.

Buy on easy terms

Get your Corona now. Pay for it in convenient monthly installments. You'll never miss the money, and you'll never want to get along without Corona, once you have found out how useful it is. The price is only $60—for both black and colored Coronas.

Our local representative will gladly leave a Corona at your home for you to examine at your leisure—and without obligation. Sold on convenient terms.

L C Smith & Corona Typewriters Inc
1213 E. Washington Street, Syracuse, N. Y.

Please send me your latest catalog illustrating the new Duco finished Coronas in actual colors.

Name .....

Address .....

How 17 Friends said "Merry Xmas" with Same Tobacco

When sixteen of a man's friends send Edgeworth to him for Christmas, it looks as though there's no doubt about the kind he wants when he wants it! Read what happened to Mr Fitzpatrick.

Evanston, Ill
December 31, 1927

Larus & Br
Richmond Va

Dear Sirs

Of course you know from your sales just how popular your brands of tobacco are but perhaps what follows will illustrate something of the identity, so to speak, of the users of Edgeworth.

I happen to be blest with a host of very fine friends (kindly highbrows pre-bizarre scientists &c). Generously at Christmas time they show their remembrance and get that with some little gift—a box of cigars fishing tackle, a bottle—all that sort of thing

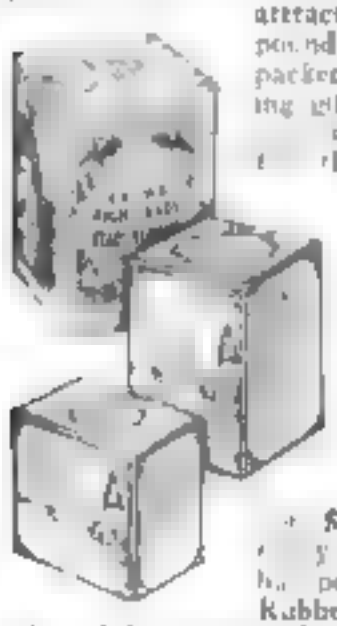
Well, this Christmas many seemed to centre on tobacco. Now, mark you, these folk we have no common bond with each other. They live in widely separated parts of the country so it was no put up job on me or anything like that. But here came seventeen boxes of tobacco, and sixteen of them the familiar blue Edgeworth. The seventeenth was a very fussy package to unwind but it had a tobacco. The contents were Edgeworth with a little pouch in it.

Just coincidence perhaps but a queer one. And not an ad. writer's order of Edgeworth as they weren't catering to any personal taste of mine. Looks like a consensus of opinion among the highbrows

[illegible] a pitch of pin that Edgeworth is the stuff the proper caper for a gift

Sincerely yours
P W Fitzpatrick

Edgeworth Ready-Rubbed comes in three favorite gift sizes for Christmas—the pound glass humidor, the pound tin, and the very attractively decorated half-pound tin. Each one is packed in a specially inviting gift carton, printed in colors. Prices: $1.65 for the pound humidor, $1.50 for the pound tin. And 75c for the half-pound tin. Please ask your tobacco dealer to show you these Christmas packages. Or, if he cannot supply you, send us $1.65 for each pound humidor, $1.50 and 75c respectively for each pound and half pound tin of Ready-Rubbed to be shipped, also a list of the names and addresses of those you wish to remember, with your personal greeting card for each friend.



We will gladly attend to sending the Christmas Edgeworth to your friends, all delivery charges prepaid

Personal: Perhaps you yourself are not acquainted with Edgeworth. If so, send your name and address to Larus & Brother Company, 10 South 21st Street, Richmond, Va. We shall be glad to send you free samples—generous helpings of both Edgeworth Ready-Rubbed and Edgeworth Plug Slice.

Edgeworth is sold in various sizes from pocket tins to handsome humidors—to suit the needs of any smoker

On your radio dial turn to station WRVA, Richmond, Va., the Edgeworth Station. It has a wave length of 256 meters. Frequency 1170 Kilocycles. Special Feature: The Edgeworth Club Hour every Wednesday evening at nine o'clock, Eastern Standard Time

Strap and Chain Prevent High-Chair Accidents

AFTER our baby had taken a dangerous fall from a high chair, we decided that the strap that reaches from the center of the tray to a position in the seat between the baby's legs was insufficient. It had its usefulness, but was not enough in itself to safeguard an especially strong, active infant. What was needed was something that would

A method—not as uncomfortable as it looks—for restraining a too-active and daring infant.

stop the baby from either attempting to stand up or toppling the chair over.

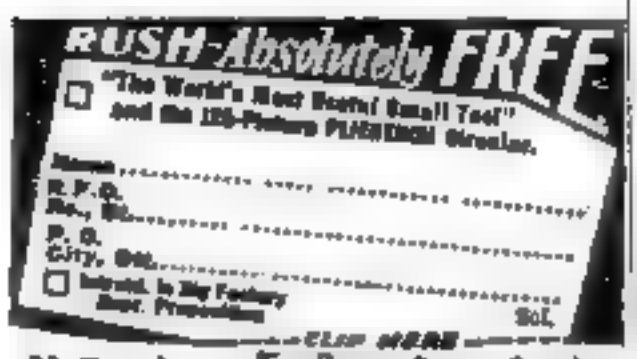
We made a little "unkette" out of strong, stiff cloth to be buttoned or tied round the baby's knees. About six inches of strong tape attached to the "unkette" and fastened to the footrest makes it impossible for the baby to stand up, yet does not unduly restrain his legs.

A short length of chain with a snap at one end was fastened to the back of the high chair and connected with a screw eye in a convenient wall so that the baby cannot possibly manage to tip over the chair.—ALFRED G. SPRENGER.

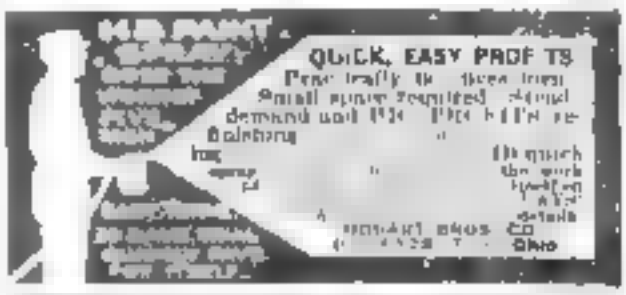
Tinsel Causes Short Circuit

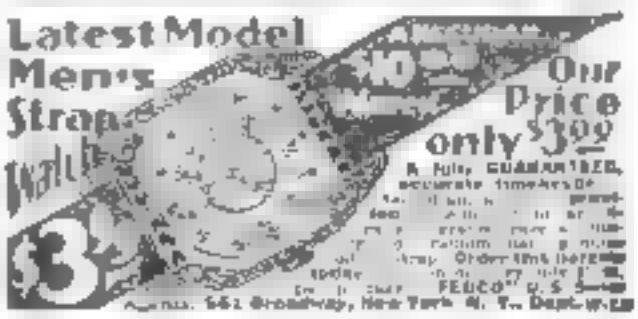
BY DROPPING a Christmas package tied with tinsel ribbon across the tracks of a toy electrical railroad, my boy caused a short circuit. The sparks set fire to the tissue wrapping around the box, and the flames quickly fired a sheet spread under the Christmas tree.

Luckily, I was within call and no great damage was done, but other readers will do well to be careful in placing boxes that are tied with tinsel cord, or any tinsel ornaments, where they can come in contact with the house lighting current or electric toys.—F. N. C.



The Flying Ace





This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Gifts Any Man Can Make

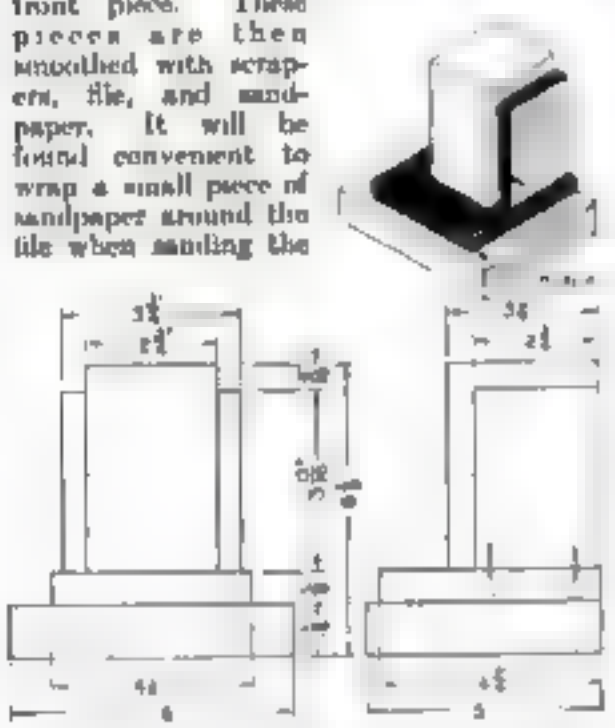
(Continued from page 67)

sparingly and not too near the edges, so that there will not be a great deal of surplus glue squeezed out when the hand screws are tightened. Smooth the rear faces of the book ends after all the blocks have been assembled. Two final coats of lacquer should be given.

In this day of small size living quarters, the hanging bookshelf and mirror illustrated on page 118 should be a welcome piece of furniture, as it makes not the slightest inroad upon the available floor space. The structural features are so simple as to bring this smart modern piece easily within the reach of the amateur woodworker.

Square the bottom, sidepieces, and partitions to dimensions, cut the rabbets on the rear edges of these pieces and the ½ by 5¼ in. recesses on the front edges. Screw the pieces together as shown and nail the back temporarily in place. Smooth the surfaces and edges at all the joints, and slightly round the corners of the end pieces.

Cut and shape the front piece and the lower member of the two-part top. A turning saw or a coping saw is necessary to cut the arcs on the front piece. These pieces are then smoothed with scrapers, file, and sandpaper. It will be found convenient to wrap a small piece of sandpaper around the file when sanding the curves. After fitting the front piece, glue it to the sides and the partitions. Insert a screw in each of the partitions to reinforce the joint, but use only glue at the ends. When the ends are dry, smooth and round them.



Could anything be simpler or serve its purpose better than this modernistic book end? It can be painted as above or as shown on page 57

The lower member of the top is next screwed to the upper ends of the sides and the partitions and is rounded on the front and side edges. The ½ in. thick member of the top is then glued in place, thus concealing the screws in the lower toppiece.

THE flutes on the edges of the partitions and the bottom are cut with small gouges. It is best to practice these cuts on a piece of waste lumber before attempting to make the final cuts. They also can be scratched or scraped in with a scraper of the correct shape held to what is called a "scratch stock," or made by means of an inexpensive but useful tool known as a "hand beader." A set of cutters for flutes, beads, and reeds are furnished with the beader. If the bookshelf is painted or lacquered, the flutes should be emphasized by means of a contrasting color.

The two screw holes in the front piece are blocked with diamond-shaped pieces of wood, which are inserted as described later.

The back is finally screwed in place after the mirror has been inserted. It is well to place several layers of paper between the mirror and the back as a protection. (Continued on page 118)

ATKINS SILVER STEEL SAWS

ATKINS
Saws and Tools for
Your Workshop

In Your Home WORKSHOP

MEN who have home workshops get great pleasure and profit in making things, with ATKINS Saws and Tools. They save time, work and material in cutting wood and metal—do the work far quicker, easier and better.

Only in ATKINS Saws do you get "SILVER STEEL," that takes a sharper cutting edge and holds it longer. Your ATKINS Saw is also "Taper Ground" to make sawing easier and prevent binding. And only ATKINS Saws have Perfection Handles to eliminate all wrist strain.

Start a home-workshop of your own with a set of ATKINS Saws and Tools. Make things you've always wanted. Save money on repair jobs! Earn money in spare time!

See These Saws at Your Hardware Dealer's

At left are shown several ATKINS Saws and Tools needed in an up-to-date home workshop. See them at your hardware store. Other ATKINS Saws for every purpose. Insist on ATKINS, and you'll find it the best tool investment you ever made.

Two Booklets on Saws—FREE

"Saws in The Home" has dozens of helpful suggestions for making things at home, and shows the best tools to use. "SAW SENSE" tells about saws and their care. Both sent FREE just mail us coupon below

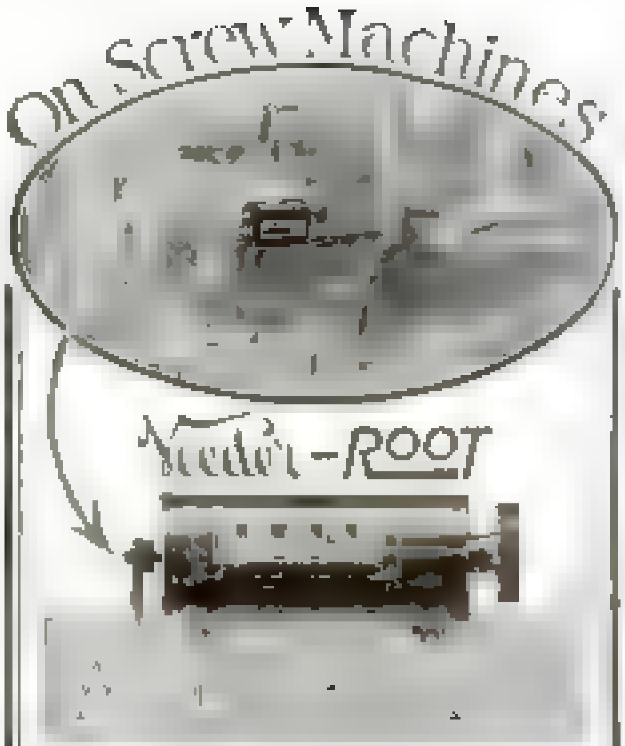
E. C. ATKINS & CO. Est. 1857
423 So. Illinois St., Indianapolis, Ind., U. S. A.
Leading Manufacturers of Higher Grade Saws for Every Use, Saw Tools, Saw Specialties, Planning Tools, Machine Knives, Grinding Wheels and Files.

Please send me your Free Books, "SAW SENSE" and "SAWS IN THE HOME."

Name

Address

My Dealer Is



show a stepped-up PRODUCTION and steady attention to the pace you set for the job

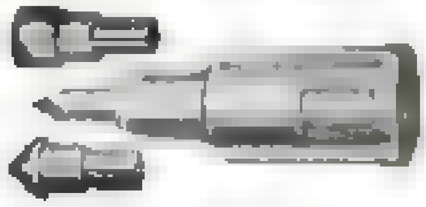
Special Counters by VEEDER-ROOT for Brown & Sharpe "Automatics." They count the production and keep it high by an every-minute check-up on the operator. Save over-runs; save under-runs which quickly cover the cost of the Counters — at

$6.50 Each

(Subject to quantity discounts; Attachments $1.00 each set no discount

Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft press lightly when the second hand of your watch comes to 0, release pressure when minute is up. A spring clutch controls the recording mechanism.



Cut less than ½ size)

The *Veeder-Root* Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at efficient speeds. Price, with two rubber tips as illustrated, $3.50.

Our brown book shows instruments that "count everything on earth" See them by sending for the book

Veeder-Root INCORPORATED HARTFORD, CONN.

Gifts Any Man Can Make

(Continued from page 117)

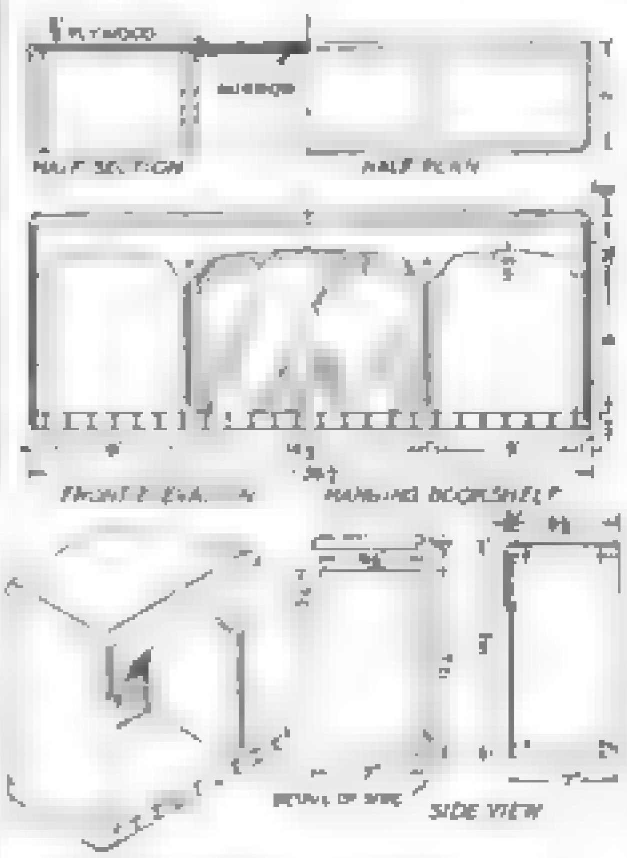
The stand, which is the third project (see page 119), is one of those low pieces of furniture that is used so much in modernistic interiors to contrast with the taller "skyscraper" pieces. It is suitable as a depository for books, magazines, smoking paraphernalia, or toys.

As the top and base are 22 in. square, it is necessary first to glue up several narrower pieces to give the required width. It may be convenient to glue up enough pieces to make about 45 in. in width and then cut this piece in the center to give both top and base.

When jointing (planing) boards to be glued, plane two at the same time, placed face to face. It is much easier than to plane one at a time, because the edges do not have to be absolutely square with the sides; if there is a slight bevel that of one piece will exactly compensate for the bevel on the other piece when the two parts are brought together. Place a framing square on the edges and test for straightness. When the edge of one board is set on top of the other, the edges at the ends should be close together, but a slight hollow in the center does not matter. If an opening shows at the ends, however, the edges must be planed again.

When clamping up the boards for gluing, place two clamps on the underside at each extremity and one on top in the center. Either cabinetmaker's bar clamps or improvised wooden clamps with wedges may be used. Tighten the center clamp before the end clamps. If the edges of the boards do not come level, blows with a hammer or, better, a mallet, will force them in line.

When the glue is dry, plane across the grain of the wide board to get the surfaces level.



Front, top, and side views of the hanging wall bookshelf, and sketch of the corner construction.

Then scrape or plane with the grain, depending upon the kind of wood used. Hardwoods like birch or maple usually have to be scraped; soft woods like pine, basswood, and cypress can be planed smooth with the grain.

After all the pieces have been squared to dimensions, screw them together as shown in the drawing. Set the screws that show at least ⅛ in. below the surface. First bore a hole with an auger bit equal to the diameter of the head of the screw and ⅛ in. deep. In the center of this hole bore another hole for the screw itself with a No. 6 gimlet bit or a twist drill.

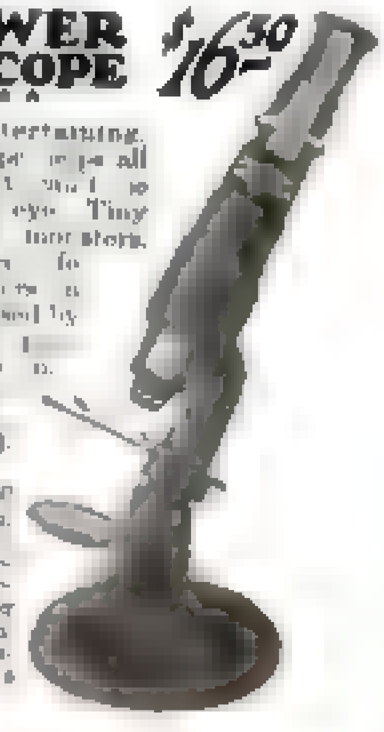
After all the pieces have been screwed together, cut the diamonds from a thin piece of wood of the proper (Continued on page 119)

PLAY YOUR WAY TO HEALTH

A compact, ... consisting of a Rowing Machine, Punching Bag, Chest Weights, ...

GYM JUNIOR CO.

250 POWER MICROSCOPE $16.50 MADE IN U.S.A.



... entertaining ... Tiny ... look like monsters. ...

Magnifies 100 to ... times. Tilting stand, fine finish, nickel trim ... Money back guarantee ...

Wollensak Optical Company
887 Hudson Avenue Rochester, New York

PARKS WOODWORKING MACHINES

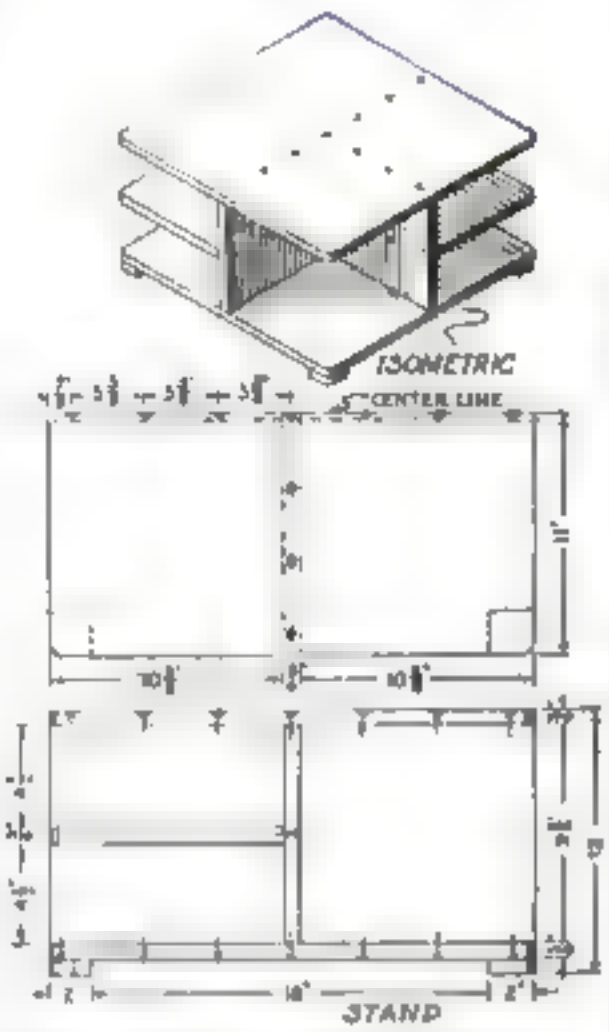
Cabinet Shop Special No. 10 $290 with Motor

You ought to have this handy Parks in your shop. Compact, complete, each of the ... production outfit at 1/5 the cost. Floor space required only 42x7... inches. Does any kind of cabinet or joinery work. Write for circular.

The Parks Woodworking Machine Co.
Cincinnati, Ohio

Gifts Any Man Can Make

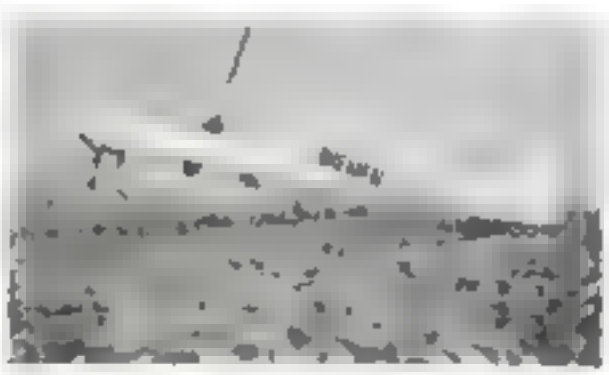
(Continued from page 118)



This low stand is one of the most popular and characteristic of modernistic furniture pieces.

width. Place each one over a screw hole and mark its outline with a sharp knife blade or steel point. Remove the wood on the inside of these lines with a ¼-in. chisel, and glue and fit the diamonds in place. When dry, scrape the surface until it is level and smooth. Apply brushing lacquer or any desired finish.

Reader Finds *Bremen* Model a Remarkable Flyer



Flying scale model of the famous Junkers monoplane constructed by Robert L. Pierce.

LETTERS from readers are especially enthusiastic about the design for a flying model of the *Bremen* given in POPULAR SCIENCE MONTHLY Blueprints Nos. 89 and 90 (see page 102). It is not only exceedingly realistic but an extraordinarily good flyer.

The model illustrated above was built by Robert L. Pierce, of Gettysburg, South Dakota, from our blueprints and the instructions in the August, 1928, issue.

"It is the most remarkable flyer I have ever constructed," he wrote, "while still being very realistic."

Anthony Wrah, of Elizabeth, N. J., won the duration trophy with a *Bremen* model at the annual meet sponsored by the Union County N. J. Park Commission, and Harry Jaeger won the free-for-all contest with a similar model.

IDEAL Model AIRPLANES

This Christmas get a Flying Scale Model of a Real Airplane!

GET the thrill of Model Building and Flying with an accurate Model of a Real Airplane! If you have built Racers, now build a Scale Model—there's fun and useful interest in this popular sport.

IDEAL Models are the most perfect copies of large Airplanes it is possible to make in Models that will fly. They are miniature duplicates of real machines, and are guaranteed to fly when correctly constructed. IDEAL Complete Construction Outfits (one shown above) show how to build them and contain everything needed, including Sealed Plans, full size Diagrams and Patterns, and complete Building-Flying Instructions.

Here are the most popular Models, pick yours now!

With the IDEAL Silver Wings and Certificate of Award for Pilots, any Model Airplane builder can earn these. Those who build and fly IDEAL Models fully deserve the honor of wearing them.

3 Ft. Flying Model FOKKER Monoplane
A perfect model of the world-famed plane which was used by Byrd to fly over the North Pole. Weighs only 1 lb. 10 ozs. and is guaranteed to fly when correctly constructed. Complete Construction Outfit $6.50.

3 Ft. Model DeHAVILLAND Bi-Plane
An accurate Model, built on actual size of the famous Aircraft. The most popular machine of Bi-Plane type ever to build and fly successfully. Complete Construction Outfit $7.50.

Flying Model "SPIRIT of ST. LOUIS"
An exact model reproduction of the most famous Airplane in the world. 36-in. wing span weighs 2½ ozs. A beautiful model that will fly when correctly constructed. Complete Construction Outfit $7.50.

CECIL PEOLI Racing Airplane
A 36-in. official Record maker. Will fly far and fast. Very easy to build; everything included to be built. Complete Construction Outfit $3.75.

64 Page Model Airplane Book 5c
Contains plans for building gliders and Racers, full directions on almost Scale Models and latest complete catalog of Parts, Materials, Fittings and Supplies for all kinds of Models. Send for a copy right away!

Plans for Model Airplanes
Complete 4-side Plans and instructions for any one of the following 5 models mailed for 25c. New York Pa... Spirit of St. Louis, Bokker, The Thrill Chaser, Nieuport Biplane, Sterlet or Tackle [illegible] Racer.

"Every Boy's" IDEAL Airplane
A handsome, 3-ft. 5 cm. plane made largely of aluminum can be assembled easily and quickly. Just the Model for younger boys. Complete Outfit, $4.00.

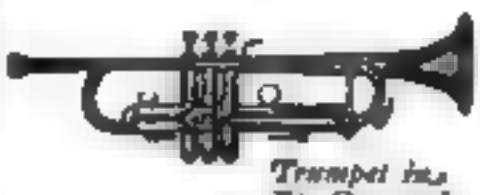
IDEAL Model Airplanes, Racing Airplanes and Supplies for Model Builders are sold by Toy, Sporting Goods and Department Stores. Ask for them by name. IDEAL if unobtainable, we will fill your order upon receipt of price. West of Denver, Colo. and in Canada, add 50 cents on each price mentioned above.

IDEAL AEROPLANE & SUPPLY COMPANY, Inc.

Largest Manufacturers of Model Airplanes—Established 1911

28 West 19th Street NEW YORK CITY

Quick! Success in Music with any of these New Conns



Trumpet in a Big Demand

Conn's new 28 trumpet with many new and exclusive features is shown by leading professionals, fast becoming the most popular trumpet in the world. Embodies improvements of fifty years of Conn experience.

The Mezzo-Soprano Saxophone in F

An absolutely new saxophone from mouthpiece to bell with new tone, now regarded as the ideal lead or solo instrument. Opens up a whole new world of music to saxophonists. Originated, developed in Conn experimental laboratories is available only from Conn or Conn dealers. To be up-to-date you must know this saxophone.

New All-Metal Clarinet

A real clarinet with all the advantages of wood model and many new superiorities. Fast replacing older types among leading players. Wonderful tone and playing qualities make progress easy and rapid with the Conn All-Metal clarinet.

FREE TRIAL EASY PAYMENTS

on any Conn instrument for band or orchestra. With all their exclusive features, Conns cost no more. Perfect scale, reliable mechanism, beautiful tone, make Conns choice of foremost professionals. Send the coupon now for free literature and details of free trial offer. No obligation. Mention instrument.

CONN BAND INSTRUMENTS

C. G. CONN, Ltd., 1232 Conn Bldg., Elkhart, Ind.

Gentlemen: Please send literature and details of free trial offer on (instrument)

Name

St. or R. F. D.

City

State, County

How to Make a Light Tea Tray Stand

By Frank O. Taapel

A TEA server is a real asset for the busy housewife during the afternoon tête à tête. To construct one requires little skill or expense for materials, especially if whitewood, redwood, white pine, cypress, or other easily worked woods are used.

The materials required are: 2 sides ¾ by 2½ by 32 in.; 2 leg pieces 2 by 4 by 19 in.; 2 pieces ¾ by 2½ by 24 in., one for the tray rest and the other for the lower brace, 1 piece ¾ by 5 by 26 in. for the handle; 2 pieces ¾ by ¾ by 12 in. for tray supports; 1 dowel stick ¾ by 24 in.; 1 piece cardboard 4 by 10 in.; glue and small brads.

One pattern serves for laying out all the curves. It is drawn upon a piece of cardboard 4 by 10 in., divided into 1-in. squares as shown near the top of the

An easily lifted stand for a tea tray which can be constructed at small cost for materials

drawing on page 121. This basic design can be changed as desired to suit the taste of the worker.

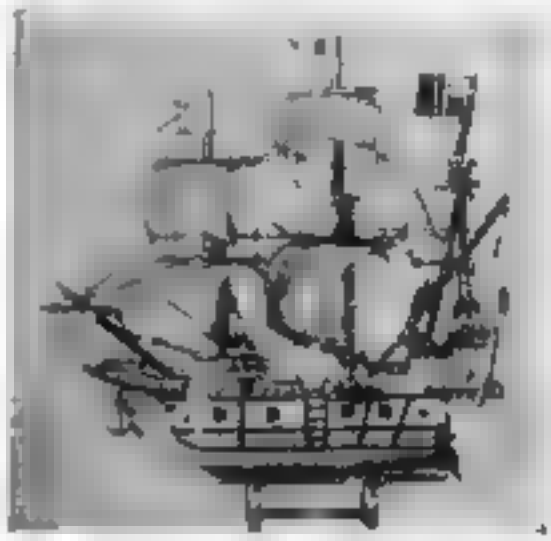
The quickest and easiest way to cut the curves is with a band saw, but good results may be obtained by using a turning saw. All the edges should be rounded with spokeshave, file, and sandpaper—not a great deal on the ends, but sufficiently on the handle to give an easy grip.

The curved feet receive the ends of the legs, which are tapered to serve as tenons. Glue and toenail the joints with 1¼-in. brads, driven and countersunk from the inside to avoid marring the surface.

Holes ¾ in. in diameter are now sunk in the ends of the tray shelf and the lower brace and also in the end pieces to receive dowels. The dowels for the lower brace should be placed so that the lower edge of the brace rests on the flat upper surface of the curved foot pieces. The upper dowels are placed so that the tray shelf is 21 in. from the top edge of the feet. The joints are glued, (Continued on page 121)

A $100.00 SHIP MODEL for $4.98

You Can Put a Beautiful Ship Model Together in a Few Hours of Pleasant Time



MAYFLOWER
SIZE 25" High, 10" Wide, 36" Long

LET the World's Largest Builders of Ship Models supply you with all the necessary parts cut to fit and ready to put together for the models, Mayflower, Santa Maria, or LaPinta. You need not know anything about ship building to assemble one of these models. If you have never seen a ship model you can put one of these models together in a few hours by following our diagram and instruction sheets which explain and show you exactly what to do with each part. All you need is a small tack hammer to tap the parts in place. The parts are numbered on the diagram, making it impossible for you to go wrong. These models when completed are exact in every detail of the famous old ships they represent, and when completed will add a distinctive touch to your home. We also have parts for the model of the Constitution at $6.98; all other models listed at $4.98 each

Write for our beautiful illustrated booklet containing photos and information on all of our models.

MINIATURE SHIP MODELS, Inc.
3818-24 Baring Street
PHILADELPHIA, PA

MINIATURE SHIP MODELS, Inc.
3818-24 BARING ST. PHILADELPHIA, PA.

Please send me the complete parts cut to fit and ready to put together for the MODEL _____. I will pay Postman $_____ plus a few cents for postage.

Please print name and address plainly to avoid delay

Name

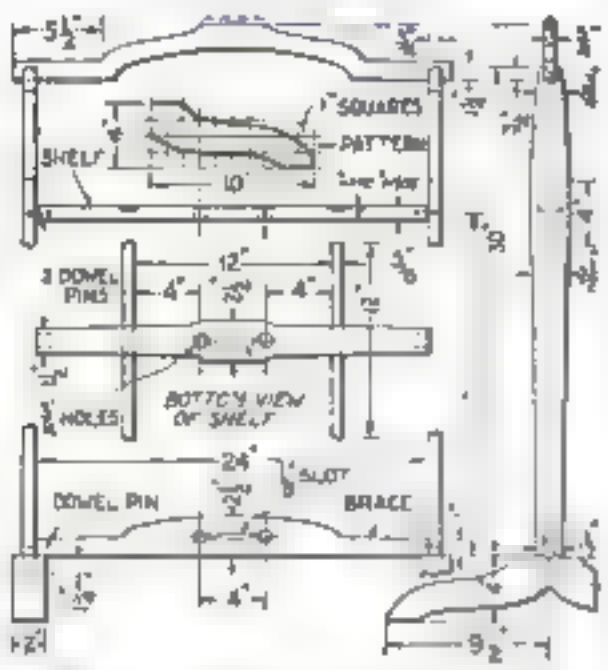
Street or R. F. D.

City

State

Light Tea Tray Stand

(Continued from page 120)



Sides and end views of the stand, bottom view of shelf and pattern for laying out the curves

fastened with small brads, and clamped and tested with a square.

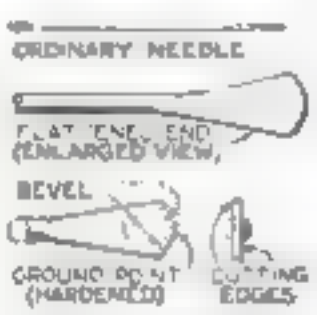
The tray may be purchased from any department store. However, one may design and make his own, using medium heavy picture framing for the sides and covering the bottom with glass.

Rubber headed tacks are cut so as to have a flat vertical surface and driven in the tray shelf press on the tray ends and hold the tray in place. If you do not wish to remove the tray, it may be placed on the support as the finishing varnish is drying. The varnish will hold it firmly.

The piece may be stained any desired color, sheflacked, rubbed down, and varnished. Either a velvet finish or high gloss varnish may be used. Lacquer too, will give a beautiful finish, and a stippled effect also would be distinctive. Tassels may be fastened to the legs.

Tiny Drills for Model Work

SMALL drills for wood or metal can be made from ordinary sewing needles. They are useful in model making. Heat and flatten the end, grind and sharpen it on an oilstone as shown, and reheat and temper the point by thrusting it instantly into sealing wax or tallow. If the shank of the needle is inserted in a piece of soft wood, it can be gripped in a hand drill, as the jaws will compress the wood sufficiently to hold it. L. C. D.

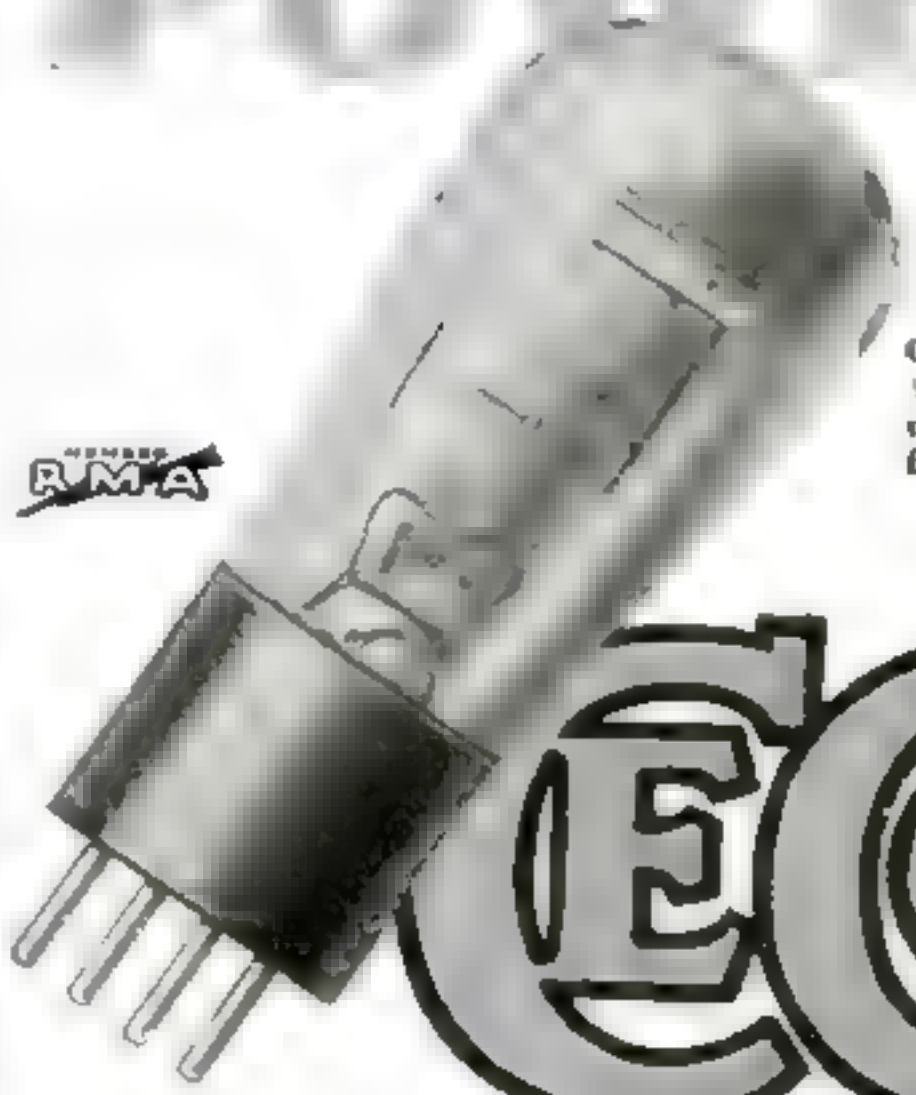


How the point of the needle is shaped.

How to Clean Tiles

TO REMOVE cement and plaster from tile floors, first scrape off as much as possible and then apply muriatic acid in the proportions of one part acid to ten parts water. Rub the marks with a rubbing stone or an ordinary oilstone such as is used for sharpening tools. The oil with which the oilstone is impregnated will have no effect on the tiles. Work quickly, do not allow the acid to remain too long, and wash it off very thoroughly.

POWER



CeCo Type J71-5 Volt ½ Amp. power Tube, using the new oxide filament. Price $3.00

MEMBER R.M.A.

CeCo

PRONOUNCED SEE—CO

RADIO TUBES

Steadier performance —longer life

They cost no more but last longer!

YOU'LL be surprised at the astonishing difference CeCo tubes make in your set! The clearer, more beautiful more natural tone they produce. Neither too hard nor too soft. Neither tinny, metallic and harsh nor soft muffled and mushy. Just a clear round full voiced natural tone that gets all the delicate tone shades and nuances of the most difficult-to-get music.

You'll like CeCo tubes—not only for their superior performance but for their rugged durability as well. An exclusive high evacuation process adds to their length of service and rids your set of disagreeable tube noises. Try these famous tubes that most well known radio experts now recommend.

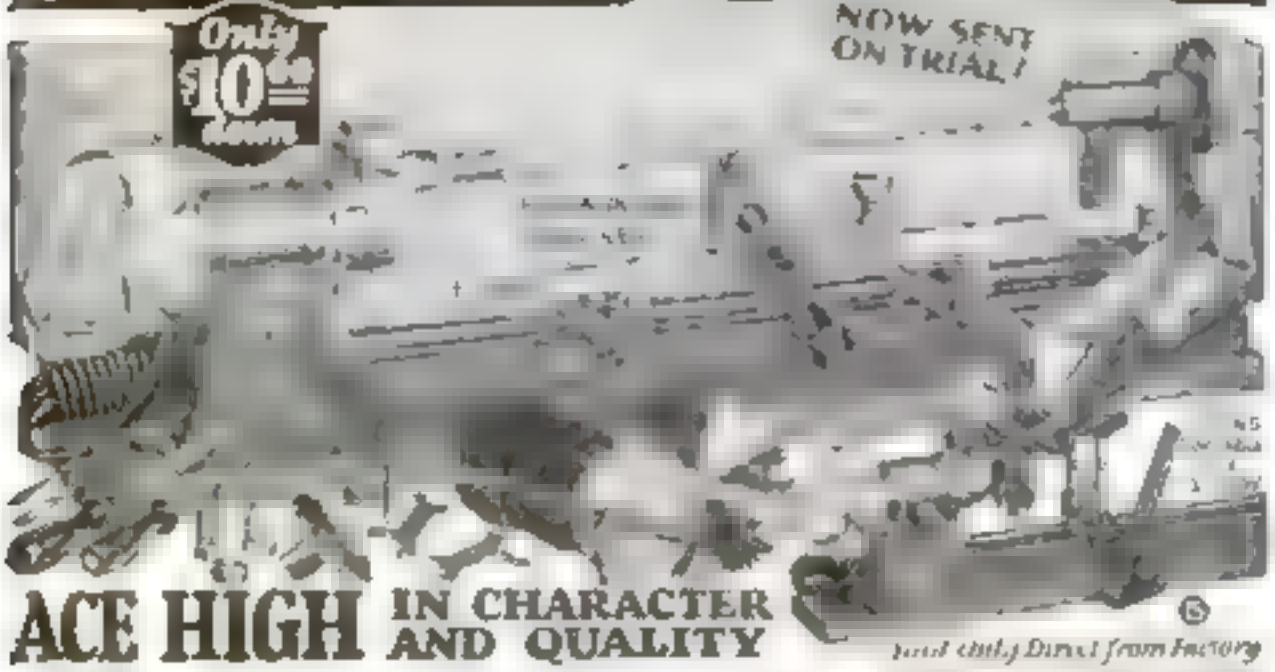
They come in AC and DC type as well as in "Special purpose" types—many not available in any other brand. Ask any good dealer about CeCo.

Write for full particulars and information about the attractive CeCo dealer proposition

CeCo MANUFACTURING CO., Inc.

702 EDDY STREET, PROVIDENCE, R. I.

The New Home Craftsman's Wonder Shop



ACE HIGH IN CHARACTER AND QUALITY

and only Direct from Factory

Portable--Interchangeable--Complete RED JACKET HOME WORK SHOP

Make Things at Home Electrically

Special Crafts Course FREE

Buy On Your Own Terms

The FAMOUS WACO GUARANTEE

free BLUE PRINTS

Send the COUPON → Interesting Literature Free

WACO TOOL WORKS, Inc.
2216 W. Kinzie St. Chicago

Name

Address

A definite program for getting ahead financially will be found on page four of this issue.

Give Him a Masonic Gift!

$1.00 For Choice — Emblem Stamped on in Heavy Gold FREE

Gifts that he will appreciate

Latest style, genuine leather, 5 window pass case, with gold trimming. Masonic or Shrine emblem stamped on free. Name or other stamping 35c a line extra. Our leader—it's a dandy. 9 windows $1.50, 13 windows $2

SOLID GOLD PIN

Just the right size. Latest style. A lasting remembrance and an appreciated present. Large variety—Masonic Chapter, 32nd Degree, Shrine, Grotto, O. E. S., De Molay $1.00

SEND FOR OUR CATALOGUE

REDDING MASONIC SUPPLY CO. INC. (Est. 1891)

Dept. P.S. 200 Fifth Avenue, New York

A Novel Charm

A most mysterious watch charm of heavy plated gold. Shows the Square and Compass when revolved. Something different. Packed in an attractive box $1. Catalog suggests many other gifts.

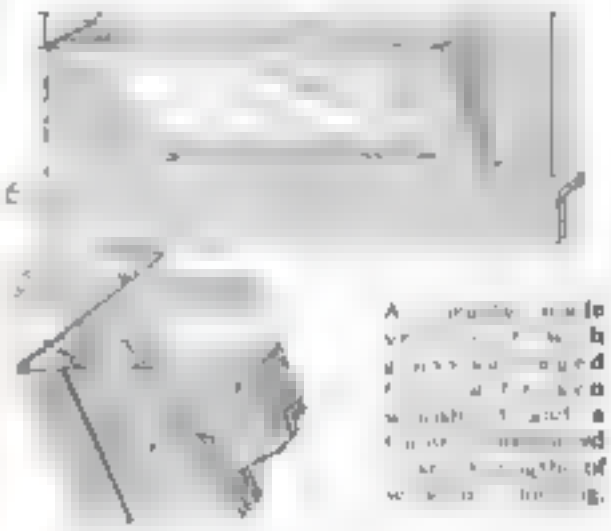
FOR YOUR CONVENIENCE

Name — City — Enclosed find

Street — State — $

Window Ventilators Made from Old Windshields

IF YOU wish to make window ventilators for your home and happen to live near a dealer in salvaged auto parts, you can obtain broken windshields for the purpose at little cost. Any pieces of broken glass, if large enough, will do. In fact, by inserting one or more grooved divisions in the frame, it is possible to utilize relatively small pieces.



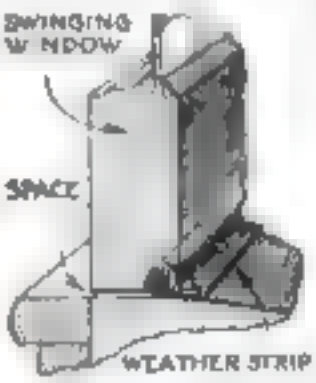
Cut two pieces of grooved flooring, with the tongues removed, to the width of the window and lay them on the bench with a piece of the glass between them. Fill in the ends with two short pieces similarly grooved, after cutting the glass.

The joints can be fastened with screws or nails after holes are drilled to avoid splitting, or they can be doweled.

The shield is held by two supports made as shown of any fairly stiff sheet metal. The woodwork should be stained and varnished or painted to match the window trim.—E. M. Cook

Casement Weather Strips

CASEMENT window sash that are hung so as to swing inwards very often give trouble by admitting wind and rain at the bottom. To remedy this, I have made a practice of applying flexible weather strips as shown. This has proved effective in every case in which it was used.—G. W. Rotha.



The weather strip is fastened to the sill.

Where the asbestos covering on the pipes of a steam or hot water heating system requires renewal, it is often possible by a little careful work to avoid the expense of purchasing new insulation.

Clean the old covering and apply strips of room-sized building paper, cut large enough to overlap the casings by about 1 in. Over this wrap a covering of unbleached muslin or light canvas and sew the edges on a butt joint with white string and an upholstery needle. A coat of cold water paint completes the refinishing and makes the coverings look new.

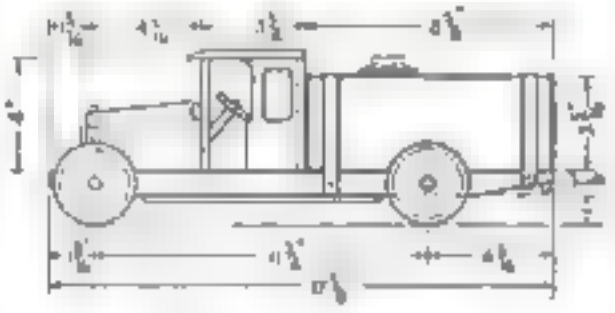
This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Fire Engine and Other Toys

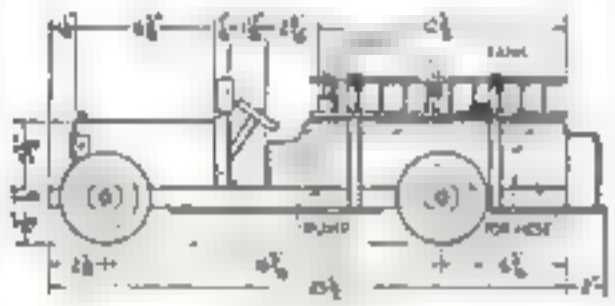
(Continued from page 122)

sawing out these thin wooden disks, slightly large, drilling a hole through each one, and nailing them all together with the holes centered, using two long thin brads. Mount a straight ⅜-in. diameter bolt, with the head cut off, in your lathe chuck, so that a good length of thread projects beyond the chuck. Screw the disks on this, nailed together, and then place a washer on the end of the bolt and screw on the nut to hold the disks in place while you turn them to size. After turning, the disks may be separated with a thin knife blade. All the wheels of the toys shown here were turned on a bolt in this way, and they run very true.

After the disks are cut out, glue and nail one thin disk to one side of each thicker disk which is to receive the tires. When the glue is dry, slip the jar rubbers in place and cement them together with rubber cement. When each tire is cemented on, glue and head the other disk on the outside of each wheel. I used another ⅜-in. bolt to make up each wheel on, so as to keep the disks lined up until each wheel was finished. Two small metal washers are placed between each wheel and the chassis



SPRINKLER TRUCK



FIRE ENGINE

Fig. 5. Side view of sprinkler and fire engine. The front and rear are shown in Fig. 6

and one under each screw head on the outside of each wheel. Round-headed wood screws No. 15, ⅞ in. long, were used to fasten each wheel to the chassis. These are ¼ in. in diameter. It is always best to have rather large holes in toy wheels, as should there be any irregularities in the mounting of them, each wheel may drop down a bit so that they will all roll when the model is pulled.

An ordinary spool with flanges about 1 in. in diameter is cut in two to make the headlights. This is slightly flattened on the side where it is fastened to the hood block, a hole having been previously bored for the screw or nail. The side lights on the front of the cab are small round wooden buttons held to the front of the cab with glue and a large tack, the end of the tack being silvered to represent a lens. The tail-light is a round red glass bead taken from a ten-cent necklace; it is screwed under the rear of the chassis with a nickel-plated, round-head screw, which serves to throw back the light through the bead.

Of course, you should obtain the can for the tank before you make your truck. If you have to buy a new full can, the housewife will know what to do with the cooking oil or other contents! Empty the can through the screw top provided; do not punch holes in it to empty it or you will have to solder them up.

In the sprinkler (Continued on page 124)

It's News for you, too

this *better, quicker* way to shave

It's a way that banishes razor-pull . . . stops face smart. A scientific method of beard-softening that gets whiskers off clean and smooth. Today we offer a simple test. See coupon below; tell us where to send your seven-day tube

A MILLION steady customers! Buying only on the basis of results. Men just like yourself . . . with coarse, stubborn beards . . . and tender skins.

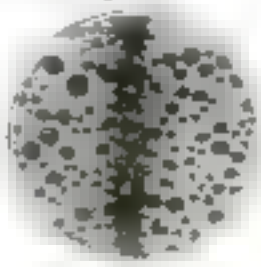
A million men . . . who have discarded old fashioned shaving methods for a quicker, easier way

There's no razor-pull, sting or smart. No drag or scrape. You get a smoother, easier shave . . . and you get it with a smile!

No other shaving cream is like Colgate's. No other can offer you such unique results.

Colgate lather is designed to absorb more water . . . to scientifically drench your beard with moisture right at the base, where the razor work is done.

It's a "small-bubble" lather. For the small bubbles hold more water and soap.



Ordinary Lather

Photomicrograph of a lather of an ordinary shaving cream after standing upon hair. Large dark spots are air, white areas are water. Note how the large bubbles hold air instead of water to soften the beard.

Colgate Lather

Photomicrograph prepared under identical conditions shows lather, closely knit texture of Colgate's Rapid Shave Cream lather. Note how the small bubbles hold water instead of air, thus softening the beard.

That's the scientific principle of it, men. Now here's what this small-bubble lather actually does when you start to shave:

1. The soap in the lather breaks up the oil film that covers each hair . . . floats it quickly away.

2. Then billions of tiny, moisture-laden bubbles seep down through your beard . . . crowd around each whisker . . . soak it soft with water

Your beard gets moist and pliable—scientifically softened at the base.

You've never had a shave like this before. You've never known such comfort. Seven shaves, just like the one described in this advertisement are now offered in the coupon below.

We'll gladly send a generous sample of our After-Shave also; men are turning to it by the thousands.

Colgate & Co. Dept. 48 L FREE OFFER MEN
Fifth Ave. New York

Please send me FREE sample of Colgate's Rapid Shave Cream. Also sample of Colgate's After Shave

Name

Address

Maydole Hammers go South with Byrd

Six houses—the expedition's base—will be built with the aid of Maydole Hammers. Planes, sleds and all mechanical equipment will be kept in working order by a complete repair shop equipped with more than forty Maydole Hammers in many styles and weights.

Press-forged tool steel heads; clear second growth, air dried hickory handles put into the heads "for keeps;" a hang that has never been equalled. These are the reasons why Maydole Hammers have been the choice of good tool users for three generations and why the *Byrd Antarctic Expedition* after careful consideration, selected them as part of their equipment.

Ask your dealer for the genuine Maydole. Write us for useful and interesting Pocket Handbook 23 "B."

YOUR HAMMER SINCE 1843

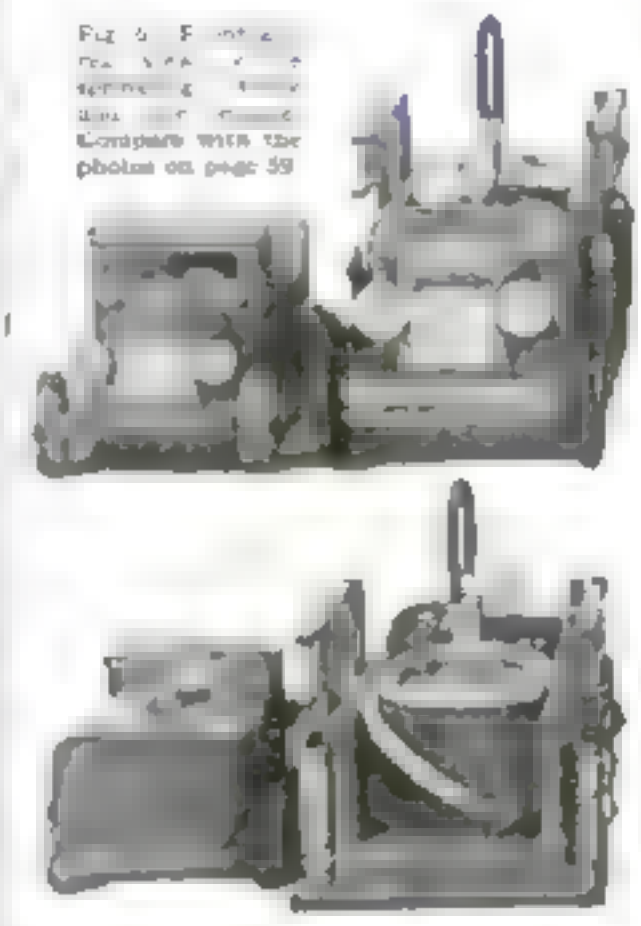
Maydole Hammers

The David Maydole Hammer Co. Norwich, N.Y.

B-254

Fire Engine and Other Toys

Continued from page 165



Complete with the photos on page 59

truck tank shown, the filler cap is on top, having been carefully melted off the end of the can with a blowtorch and the hole left in the can covered with a disk of tin. After making the truck, I decided that it might have been better to have left the screw top in the original position on the end. Then the truck could have been stood on end while being filled with water, and when it was put down level the water would run out of the sprinkler holes. After the water has started to run, it may be stopped by screwing down the cap, if this is made air-tight. The sprinkler holes are punched in a row with a sharp ice pick, each hole being about $\frac{1}{16}$ in. in diameter, or slightly less.

You may, of course, put any kind of a body on such a simply made chassis. A round can may be used for the tank truck, or a box or crate body made and fastened on the chassis back of the cab.

THE entire chassis and the body of the truck are painted a khaki color, first having been primed with thin shellac and then painted with ready-to-use household paints. Lacquers may be used, if preferred. The wheels are painted Chinese red with silver stripes or rims. The straps that hold the tank to the chassis are made of strips of bright tin. The radiator is represented with silver paint; the ends of the spoons used for headlights are silvered, as is the filler cap on the radiator, and the headlights.

To make an even stripe or rim on each of the red wheels, I placed each wheel back on the bolt in the lathe chuck on which it was turned. Then I held a small brush, charged with silver paint, against each wheel edge where the stripe was to go, the brush resting on the tool rest, as I turned the lathe slowly by hand.

How the tractor is made is shown in Figs. 1, 7, and 10. The chassis is $\frac{3}{8}$ by $3\frac{1}{2}$ by 12 in. The 8-in. driving wheels are screwed directly to this, but the $3\frac{1}{2}$-in. front wheels are screwed to a rigid wooden axle, $\frac{3}{8}$ by 1 by $4\frac{1}{2}$ in., which is glued and nailed or screwed under the front end of the chassis.

The radiator is a block $\frac{3}{8}$ by $3\frac{1}{2}$ by $3\frac{1}{2}$ in. Two more pieces are cut out the same size and shape as the radiator, or a single block made to be mounted 5 in. back from the radiator. Between these parts at the top is fitted a piece of wood as shown in Figs. 1 and 7. These may be glued and nailed

Continued on page 185

The MOCAR

Model Airplanes THAT FLY

Set No. 1, Only

$1.50 Complete

Aluminum Construction

BOYS! at last here is a genuine aluminum model airplane that really flies. And at a small price.

The Mocar monoplane set No. 1 is a copy of the famous [illegible] plane. With special [illegible] and [illegible] propeller rubber [illegible] wheels. Weight complete only about 2½ oz. This is a real [illegible] that will [illegible] give you a whole lot of fun for the modest cost. The all metal construction makes it [illegible] to get out of shape. The outfit is shown at our [illegible] with all parts plainly marked and full directions for assembly. Price only [illegible] complete with [illegible] and 4 disc wheels, wing and fuselage covering material, only $1.50 postpaid. 3 for $4.00.

Great fun, learn how to make and fly airplanes. Order now. Jobbers, dealers and schools write for Discounts.

The Mount Carmel Mfg. Co.

Dept. 5 Mount Carmel, Conn.

Among those presents

RIGHT up in the front rank of things to give for Christmas put Eveready Flashlights. Not only because that's one of the easiest and most successful ways out of the Christmas-gift dilemma, but because it's the *sensible* thing to do.

Everybody, from six to sixty, wants a genuine Eveready. Not just "a flashlight," but a genuine Eveready. Yes, it's important to insist on this point. Genuine Everedays have ALL the newest and best features. There are models and types for every possible purpose.

This year, brighten the lives of all to whom you give. Start them *right* with the flashlight habit, that national movement to save skinned shins, banged heads and ripped clothes. Give them the world's best portable light-maker—a genuine Eveready Flashlight.

The Midget "Five-in-One" Slide Rule

[illegible] multiply and divide any combination of whole numbers, fractions, [illegible] and decimals. Gives every root and power also Logs. Sines and Tangents. Made of aluminum with scales on white enamel. Size 5 in. Approved and adopted by engineers. Price with instructions $1.50. Leather case for same, 50 cts. Postpaid. Cat. showing Free. GILSON SLIDE RULE CO., Bonart, Florida

Fire Engine and Other Toys

(Continued from page 124)

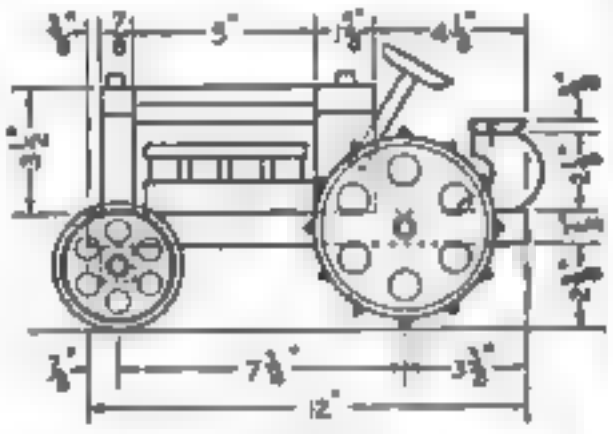
together and then nailed and glued to the tractor chassis.

A slanting hole is bored in the back piece for the steering column. To the top of this piece is screwed a large wooden button mold, spool top, or wooden disk. The seat is a button mold or disk of wood, with a piece cut off. It is glued and screwed to a springlike form of wood.

The engine block is made of wood. The sides slant in toward the cylinders, which are short lengths of dowel stick glued to the base block. The cylinder cover is a length of wood glued and nailed to the tops of the cylinders. Short spools also make good cylinders.

The large wheels may be solid disks of wood, sawn or turned, but the ones shown are made up of three disks of wood, each ¾ in. thick, glued and nailed together, with the grain of the center disk running across the grain of the other two. This makes a very strong wheel, and it is also much easier to form if you have no lathe. You can cut the disks with a coping saw.

Six holes are bored on each wheel to make it more realistic. The cleats are upholstery nails



TRACTOR

Fig. 7. Dimensions of the tractor, the front and rear views of which are shown in Fig. 10

with cone-shaped brass heads driven in the rim; or, if you like, short lengths of wood may be nailed across the rim for cleats, as on some tractor wheels.

The front wheels are each made of three disks, the center disk being of laminated wood, if available. (You can make small pieces of laminated wood by gluing firmly together thin berry-box wood, the grain of the center piece running at right angles to the pieces next to it.) This center disk is glued between two thicker disks of a smaller diameter, to make the characteristic front wheel of a tractor.

The tractor wheels are painted Chinese red with silver rims and cleats and the steering wheel and seat are of the same red. The chassis and other parts of the tractor are painted jade green, except the engine, which is dull gray. The front and back of the radiator is silver, as are the filler caps.

Small shaped bits of wood may be attached to the engine block and painted with gold paint to represent carburetors and other brass parts.

The fire engine is illustrated in Figs. 2, 5, and 6. It is a good plan to make the tank and pumping arrangements before you build the wooden parts.

First get a half-gallon can of the type shown —a strong well-soldered can that may be made air-tight. If the can is new, the oil should be emptied out (the cooking oil may be put in glass jars until used). To empty it, remove the screw cap, carefully puncturing the top of the screw top without destroying the threads on it. Use a blowtorch to melt off this entire piece, which is soldered to the can. It may be pushed off with a stick when the solder is melted. Use only enough heat to loosen the solder. This will leave a large round hole in the end of the can. Now wash

(Continued on page 150)

THE ORIGINAL UP-TO-DATE HOMECRAFTSMAN SHOP

A Real Home Work Shop fully equipped to handle any job you wish to make. Just what every handy man desires, an electrically driven assembly of real wood working tools. Plug in your regular light socket, no transformers no additional set up expense. It is completely assembled and ready for real work. Our 10-day Free Trial gives you the opportunity to see and use this Little Giant at our expense. Use the corner coupon now.

OUR VERY LATEST DEVELOPMENT

SENT ON TRIAL

ONLY $10 DOWN

HOME MECHANICS EASY WITH THIS EQUIPMENT

This shop can be used in any home lighting fixture, thus making of your old-fash ned work bench a complete machine shop, which is portable, convenient and so inexpensive that anyone can afford such equipment.

The Shop Complete consists of a Super-power Motor, an accurate Lathe (10"x48"), a 6" circular saw with 3 features the bevel, miter, side and depth gauges, a Tilting Table Jig Saw and all accessories for buffing, grinding, cleaning and all portable or stationary drilling and sawing.

Blueprints and Craftscourse Free to Users. Under supervision of Master Craftsman Eugene Maurer, blueprints and craftscourse are complete information to home handicraft and details for making hundreds of pieces of woodwork. This service **Free** to Up-to-Date Home Craftsman Shop users.

Your own terms on purchase $10.00 down. Liberal discount for cash.

GUARANTEE! If upon receipt of the Up-to-Date Home Craftsman Shop you are not satisfied without question every cent refunded and return express charges paid.

OUR LITERATURE GIVES ALL DETAILS

MAIL THIS FOR FULL PARTICULARS TO

Up-to-Date Machine Works, Dept 24
2415 S. Wabash Ave., Chicago, Ill.

Manager Dept 24. Without any obligation please send all particulars about your shop, 10-day free trial, free literature. Also craftscourse also Give us name nearest seller.

Name

Address

Every Handy Man needs

SMOOTH-ON NO. 1

for stopping leaks on steam, water or gas pipes, mending cracks, or leaks in furnaces and boilers, radiators, tanks, sinks, pots and pails, making loose handles tight, tightening loose screws, hooks, locks, door knobs, etc., stopping leaks in automobile engine water jackets, in radiator, hose connections, gas tank and gas, oil and exhaust lines, making a fume-proof joint between exhaust pipe and tonneau heater, keeping grease cups, hub caps and nuts from loosening and falling off, etc. Hardens like iron and stays everlastingly tight.

To make wet cellars dry use SMOOTH-ON No. 7

The one practical waterproofing that you can apply yourself, easily from the inside, to wet or dry surface and with every assurance of the tough watertightness, even in the wettest seasons. Effective in wet boiler pits, in cracks and porous spots and also excellent for patching and waterproofing any concrete, brick or stone surface to keep water out or in.

Write for FREE BOOK

About 25 lbs. of Smooth-On No. 7 are required for each 100 square feet of surface covered, and no experience is necessary.

To get perfect results, write to us for and *Use* the Smooth-On Repair Book. Free if you return the coupon.

SMOOTH-ON MFG. CO., Dept 38,
574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name

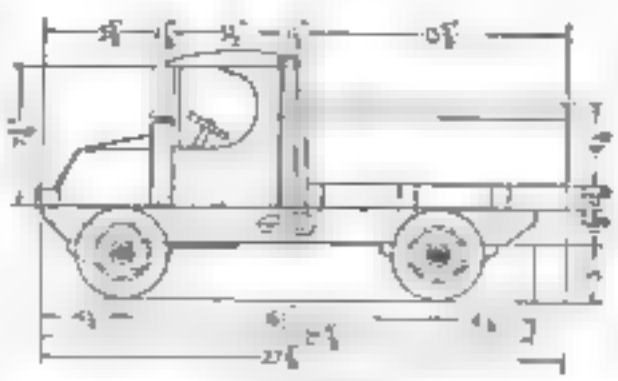
Address

12-28

Return this coupon for a FREE copy of Booklet

Fire Engine and Other Toys

Continued from page 124



DUMP TRUCK

Fig. 8. Of impressive size this truck is an exceptionally rugged toy for rough play.

out the can thoroughly with soap and warm water. Leave this hole open until all the other soldering is done to allow air and moisture to escape.

If the screw top provided with the can has a well defined thread (which most of them have not) and will screw up air-tight, it may be used for the filler cap on the tank. It will generally be found much better to cut or melt off a better top from a can such as is used to hold liquids for mending leaky radiators.

Scrape away the label on the can where the filler top and the tire valves are to be soldered, and proceed to solder the filler top to the top of the tank. A job like this had best be done by someone who has done such work before, as it is apt to be difficult for one who does not understand soldering. (An excellent flux for tin and brass is made of equal parts of muriatic acid and glycerin.)

After soldering on the filler top, punch a hole in it to admit a small funnel in top of tank right under the open top of the filler.

Next obtain two bicycle tire valve stems, also one good valve inside assembly. Scrape the dirt like ends of each valve stem bright and clean, then tin each one with a hot soldering iron, well charged with solder. Also tin the tank where the valves are to be soldered. Punch a hole with a sharp ice pick in the tank where each valve stem is to be soldered. Hold each in position with small pliers or a wooden clothespin while soldering it on the tank.

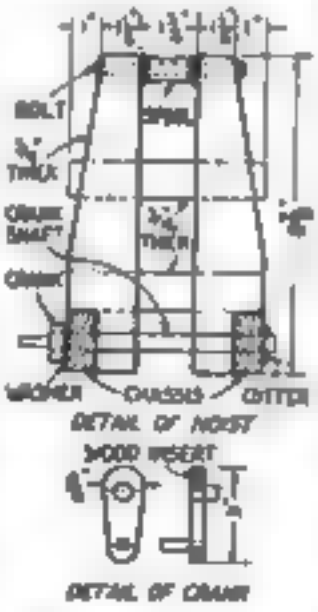


Fig. 9. How the hoist and crank are made.

When the valve stems and filler top are soldered, cut out a disk of clean tin and solder it over the hole in the end of the tank left by melting off the filler cap. To see that the tank is air-tight, first screw the valve insides in the valve stem on top of the tank, attach a small bicycle tire pump to this in the usual manner, and then screw on an extra valve cap on the other open valve stem on the end of the tank. Place the whole tank under water and pump it up with a moderate pressure. If there are any leaks, the escaping air bubbles will show it. The filler top or screw cap should, of course, be provided with a leather or cork washer inside.

If all is well, remove the tank from the water, open the screw cap, and fill the tank about three fourths full of water. Remove the extra valve cap and attach a length of hose with a nozzle made

Continued on page 127

THE LUCKY BOYS Will Get Them This CHRISTMAS

How'd you like to have an air rifle that looks and feels like a real Remington .22 calibet repeater? Wouldn't any boy be crazy for one? Can you imagine a better Christmas present?

Remington has made just such an air rifle for you. It's a fifty-shot repeater built on the lines of a Remington .22 rifle. There are no levers sticking out to spoil the looks and pinch your fingers. The stock and fore-end are made of fine American walnut and it has a pistol grip.

And, oh boy! how it shoots! You'd never believe you could shoot so far and so straight with an air rifle. It's safer, too, because it has some special safety features to keep it from going off accidentally — just like a rifle that shoots cartridges.

We can't describe half the improvements in this short space, but you can see them for yourself at your hardware or sporting goods store. When you get your hands on this air rifle and throw it up to your shoulder, you'll know what you want this Christmas. We'll send you a circular telling all about it if you'll write us for one.

REMINGTON ARMS COMPANY, INC.
Originators of Kleanbore Ammunition
25 Broadway New York City

Remington
AIR RIFLES

© 1928 R. A. Co. DEC

Fire Engine and Other Toys

Continued from page 140

of the spout of a sewing machine oil can. Pump up the tank after screwing on the filler cap. If you have made a good job of it, the water will certainly squirt out of the hose nozzle.

The chassis of the fire engine is $\frac{1}{8}$ by 6 by 25$\frac{1}{2}$ in. Underneath this are attached a board $\frac{1}{4}$ by 7$\frac{1}{8}$ by 10$\frac{1}{4}$ in. to form the running boards, and another $\frac{1}{4}$ by 7$\frac{1}{8}$ by 5$\frac{1}{8}$ in., to form the rear platform. The latter should be attached after the sides or body of the fire engine is in place, because the piece of wire or rod forming the rear handles are first pushed in holes bored for them in the sides of the body. The platform, after having holes bored in it for the ends of the handles, is then fitted on, glued, and nailed.

The radiator and hood are made of a single or built-up block of wood 3$\frac{7}{8}$ in. wide, 3$\frac{1}{8}$ in. high, and 6$\frac{1}{4}$ in. long. The cowl board is $\frac{3}{4}$

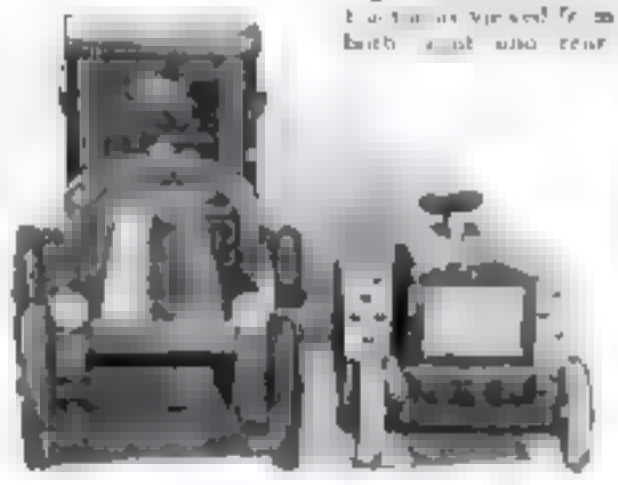
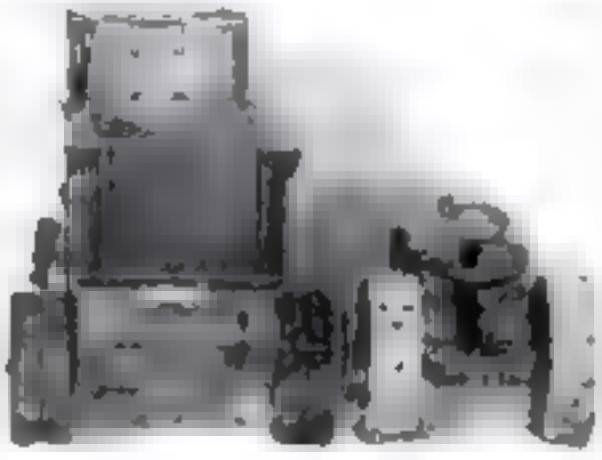


Fig. 10. The truck and [illegible] as seen from both right and rear



by 5$\frac{7}{8}$ by 6 in. In this board is drilled a slanting hole for the steering column, which is a length of dowel. The steering wheel is a 3$\frac{1}{4}$-in. disk of laminated wood with four holes bored in it. Tacks are driven in the cowl board to represent various gages and the foot and brake pedals.

The sides of the body are single pieces of wood $\frac{1}{8}$ by 3$\frac{5}{8}$ by 14$\frac{1}{2}$ in., with a little strip of molding glued to the outer edges along the top. The seat is a single block of wood on which is glued a thinner strip to represent upholstery.

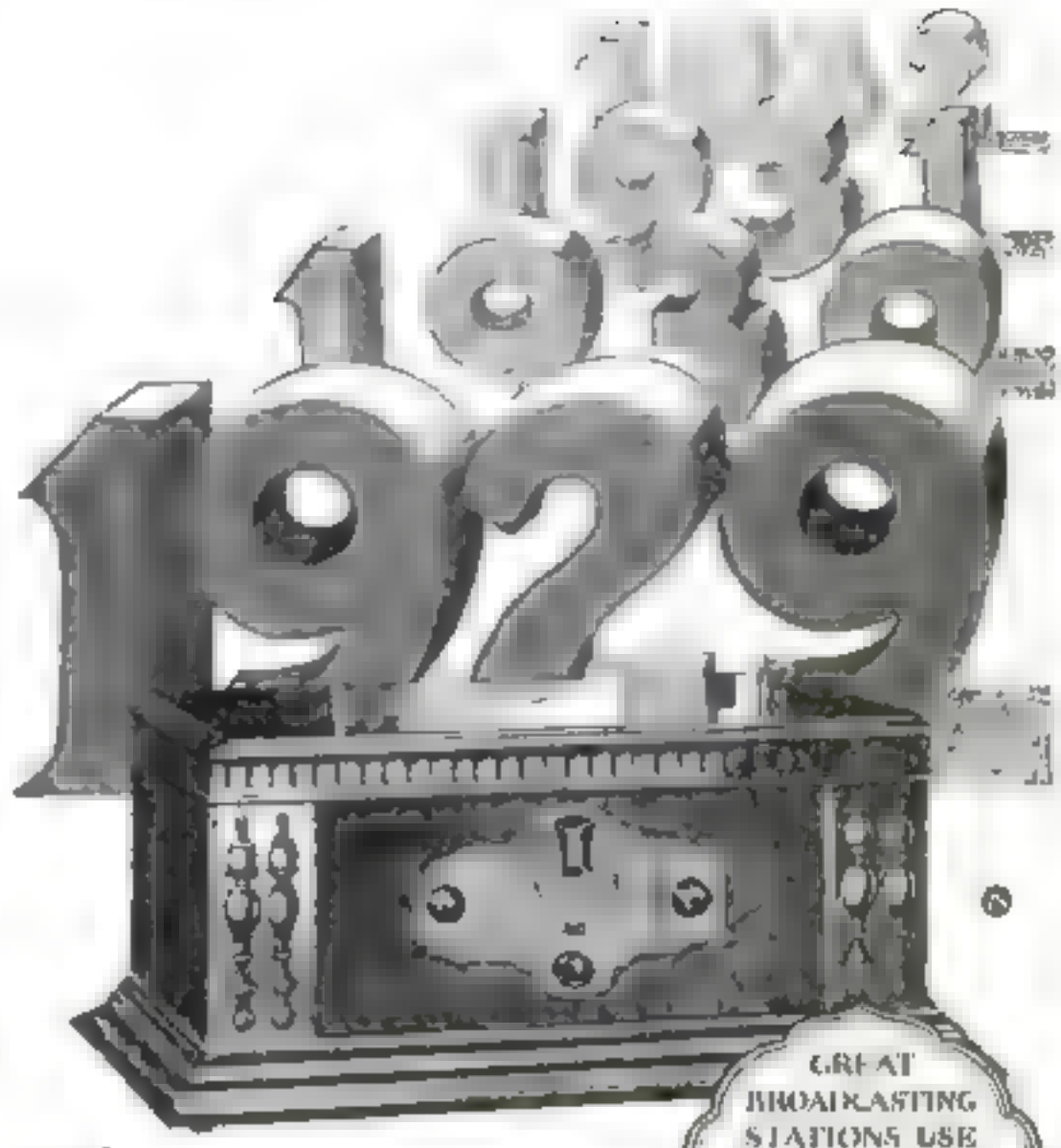
The ladder supports, provided with cup hooks to hold the ladders, are attached as shown in Fig. 8. The ladders are made of narrow strips of pine or whitewood drilled out for the rungs, which are made of a $\frac{1}{8}$-in. dowel.

Just back of the front of the body are two wooden blocks that fit between the body sides and the pump to hold it in place. A hole is drilled in the chassis for the end of the pump to rest in. Thick shellac may be used to cement the pump in place.

Two screws and washers in the top of the blocks hold the tank in place. One screw and washer hold down the rear of the tank, the washer engages the edge of the can, next to the floor, and the screw is driven into the floor.

The headlights are made of one large spool cut in two. The large end of each piece is turned to a funnel or reflector shape. When painted with

(Continued on page 188)



GREAT BROADCASTING STATIONS USE Day-Fan TO LISTEN TO THEIR OWN PROGRAMS

The THINGS that will ALWAYS MAKE RADIO FINE,

There are qualities to be found in radio sets of the present day which spell enduring satisfaction for the purchaser. These are fundamental things that constitute fine *musical* performance. They are measured by standards that do not change with the seasons.

Hear the rich, full, gloriously true *tone* of the new Day-Fan 8-tube all-electric receiver. Turn it to full *volume*, and discover how faithfully the music is reproduced, still. This is performance that must always charm.

There's the *power* to let you range for distant broadcasts—and *selectivity* that's sure.

Advanced design . . . refinements by Day-Fan engineers are responsible. There are *four* stages of radio frequency . . . push-pull amplification (two power tubes in the last audio stage) and other notable features.

The beautiful walnut Table Model is $150, less tubes and speaker. Table Model with a speaker table to match, $205.

We've published a booklet by a radio authority—an impartial discussion of what you should demand in today's set. Write for it. Just clip this ad, write your name in the margin and mail to us.

DAY-FAN ELECTRIC COMPANY, DAYTON, OHIO

For 39 years, manufacturers of high grade electrical apparatus.

Day-Fan 8 All-Electric Radio

SIGNATURE

The Improved and Mightier

TRIMO

has arrived

Out on the oil pipe lines, the final proving ground of every pipe wrench, a new tool has arrived today—the IMPROVED AND MIGHTIER TRIMO. It is the strongest and safest wrench of its kind ever built.

And today, at your hardware dealer's, that same IMPROVED AND MIGHTIER TRIMO is ready for you—ready to demonstrate the well-nigh unbelievable strength of its scientifically best treated handle—its trouble-proof braced frame of new and more powerful design.

From now on, you can take the sting out of troublesome pipe wrench work with the new TRIMO — improved and mightier in a dozen trouble-saving, time saving ways.

TRIMONT MFG. CO. Inc.
ROXBURY (BOSTON) MASS.

Fire Engine and Other Toys

(Continued from page 127)

aluminum, it catches the light realistically.

The searchlight on the cowl is a flat disk of wood ⅜ in. thick and 1⅜ in. in diameter with the back edge rounded over. A hole is drilled through it for the long screw on which it turns and a metal washer is placed between the searchlight and the cowl. The red rhinestone buttons used for the side and tail-lights, which are ⅜ in. in diameter, are set in shallow holes. Eighteen of the buttons cost ten cents at a ten-cent store.

The four dummy fire extinguishers are turned, or each can be made of a length of dowel with a short dowel of a smaller diameter glued to the top of it. Round shoe laces are used for hose and nozzles. The extinguishers may be set on dowel pegs mounted in the running boards and rear platform so that they may be lifted off.

A very small gong is mounted on the right side of the fire engine seat. But a small friction top can lid will make a good substitute.

THE wheels are flat wooden disks ¾ in. thick and 4⅛ in. in diameter. A wooden button mold or spool end 1½ in. in diameter is glued on the outside center of each wheel. The toy tires, usually obtainable at large toy stores, are stretched over the wooden disks.

Except for the parts painted silver or black as shown in Fig. 2, the entire fire engine is painted a Chinese red.

The dump truck, Figs. 3, 8, 9, and 10, is the largest of the four toys. The chassis is built somewhat differently from the others, in order to allow the body to be raised to a better position for dumping. A very good truck of this kind may also be built on one of the simpler chassis previously described.

The chassis requires two beamlike pieces ¾ by 1⅞ by 23½ in. These are held 4½ in. apart at the front end by a piece ¾ by 4¼ by 11⅞ in. that runs to back of the cab. The dummy springs are spring-shaped pieces of wood screwed to the underside of the chassis as shown. Between the two front springs is fastened a piece ⅝ by 1 by 4⅝ in. to represent the front axle, and between the two rear ones is a piece of wood cut from a piece ⅜ by 2½ by 4½ in. to represent the rear axle and differential housing (see Fig. 10).

The body rests on three cross members, notched out as shown. Two of them are ⅜ by 2¼ by 6 in., and the forward one is ⅜ by 1¾ by 6 in. The body is hinged to the rear crosspiece with a common steel butt hinge.

THE running boards or steps are made by gluing and screwing a length of wood ½ by 3½ by 9 in. under the chassis.

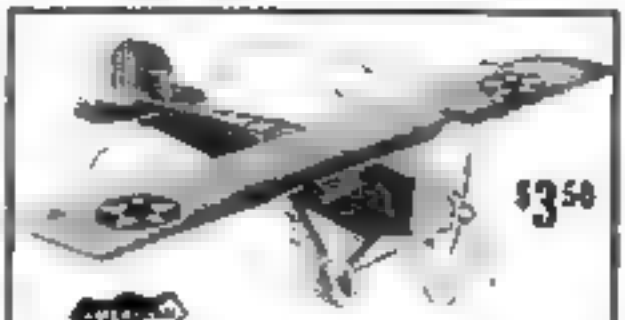
The hood is shaped from a block 3½ in. high, 4½ in. wide, and 5½ in. long. The radiator block is 1½ in. thick, 4⅛ in. high, and 6 in. wide. The filler cap is a screw cap from a shaving cream tube, fastened to the block with a round-headed screw. Two green rhinestone buttons are set into ⅜-in. holes bored in the front of this piece for side lights, and a red one is set in the rear end of one of the chassis beams. The buttons are cemented in with shellac.

The headlights are made of a spool as in the preceding models, and a green or yellow rhinestone button is pushed or cemented in each.

The cab consists of a front and rear piece ⅜ by 5⅛ by 7½ in., and two sidepieces ⅜ by 1½ by 7½ in., cut with a coping saw. The top is made of a thicker piece of wood (⅜ by 5 by 6 in.), planed and sanded to give the characteristic curve at the top. The front end may be made, if preferred, by gluing and nailing two uprights to the radiator block with a cross member between to support the roof. The steering wheel and seat are made as before.

The hoist is made of two wooden uprights shaped and mounted on the chassis and to the cab back as shown.

(Continued on page 159)



$3.50

Designed Like and Flies Like a

REAL AIRPLANE

Will fly beautifully and is extremely *durable* . . . good for many hundreds of flights without damage.

Has all-metal motor mount, sturdy wings, scientifically designed aluminum propeller and shock-absorber landing gear with rubber-tired wheels.

The Scout Model shown above, well packed, will be sent prepaid anywhere in the U. S. for $3.50. Other splendid American Models are: Spirit of St. Louis, Fairchild, and Fokker, at $5, and the Bremen at $7.50. Every plane tested at the factory and guaranteed to fly and land like a regular plane. Order now and let the fun begin!

Glider Given With Catalog 10c

AMERICAN MODEL AIRCRAFT CO.
DEPT. 3 P. O. Box 1482 NEW HAVEN, CONN.

BUILD a Working Model Ship Coaler

It's an ordinary toy. It really "grabs" coal, pebbles or whatever you wish, carries them to the chute and dumps them in your ship or truck, all at a high rate of speed! You just sit at the controls and make it run! You can build it yourself with your own hands.

Or, if you prefer, you can make a real scale model automobile just like a big one from gear shift to differential! Or a tri-motored airplane that works.

We send you an easily understood instruction booklet for any one of these models, free! Booklet usually costs 10c. Send 20c if you want all three. Just send us your name and address and that of three of your friends. Mention which booklet you wish. A wonderful chance. Act now.

MECCANO COMPANY, Inc.,
Dept. K-2 Elizabeth, N. J.

THIS OFFER WORTH 10¢

Learn How to Box

JIMMY De FOREST
BOXING COURSE

Teaches by mail the Same System he taught Champion JACK DEMPSEY

In 12 weeks, under the System of Jimmy DeForest, WORLD'S GREATEST TRAINER AND MAKER OF CHAMPIONS, you will master the priceless knowledge that made Jack Dempsey his millions, and fortunes for a host of other Jimmy DeForest-trained ring stars. Boys who were "easy marks" for bullies and fighters are today earning big money, winning hard-fought battles, making friends, and have gained the art of self-defense. Send today for the new famous book "THE GREATEST BOXER IN THE WORLD," greatest book of its kind ever written, full of valuable information, photos of great fighters and scenes like breaking engagement over night. Enclose 10c to cover cost of mailing, etc. WRITE NOW.

JIMMY DeFOREST BOXING COURSE
347 Madison Avenue, Box 2220, New York City

Fire Engine and Other Toys

(Continued from page 128)

in Fig. 9. Bolt holes are bored at the top for the bolt on which the spool pulley turns. The crank handle may be made of thick laminated wood or of soft wood. The holes in it should be bored before the crank shape is sawn out, then the crank and shaft are glued in. Deep saw cuts are made in each end of the crank and part way into the dowels so that a piece of thin berry-box wood can be glued in each cut, across the grain, to prevent the handle from splitting. One end of a strong linen tape is screwed to the lower part of the front end of the truck body with short screws passing through a narrow strip of tin across the end of the tape, which also may be glued to the body. The other end of the tape is secured to the crank shaft, between the bosts, in the same way.

The body is a strong box of ¼-in. wood, 4½ by 6 by 13¾ in. in outside dimensions. The rear end is left open. A sliding tailboard fits in between narrow strips of wood, or slides may be nailed and glued in place so that this tailboard may be pulled up or removed for dumping. Along the top of each sidepiece is a simple molding made of a planed strip of wood (see Fig. 10).

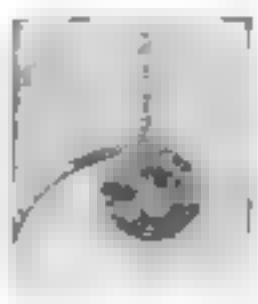
THE wheels are 4¾ in. in diameter, of white wood, birch, or maple, turned to represent disk wheels with large truck tires, but excellent ones may be made of plain sawn disks. Notice that double wheels are used on the rear end (Fig. 10). These wheels are secured to the chassis by large, strong round-headed screws, two or three iron washers being placed between each wheel and the chassis, and one under each screw head.

Extra strong axles may be made for this truck by using lengths of ⅜ or ½ in. diameter soft steel rod to run across the chassis and through the wheels. Steel washers are used as before and the ends of each axle are riveted over to hold the wheels on, an iron washer being under each rivet head thus made and the wheel. In this event the wooden front and rear axles may be set forward slightly to clear the steel rod, or a hole may be bored clear through each to take the axle.

The chassis of the truck is painted Chinese red, as are the wheels, steering wheel, hoist, and headlights. The hood, radiator, cab, and body are painted black, the inside of the cab is jade green, and the inside of the body, khaki color. Silver paint is used to stripe the wheels, for the crank and pulley, on the sides of the radiator, front of the headlights, filler cap, and bolt heads on the hoist. The top of the seat inside the cab is painted black, and the tires on the wooden wheels, a dark gray or rubber color.

Adjustable Cord Fastener Made from Washer

A GOOD rope tie for holding a ventilator cord or similar purposes is illustrated. Nick a ¾-in. or smaller washer as shown, and run the rope through it. To fasten, lay the loose end of the cord in the nick, carry it around under the nail behind the washer, and wedge it on top between the tight portion of the rope and washer.

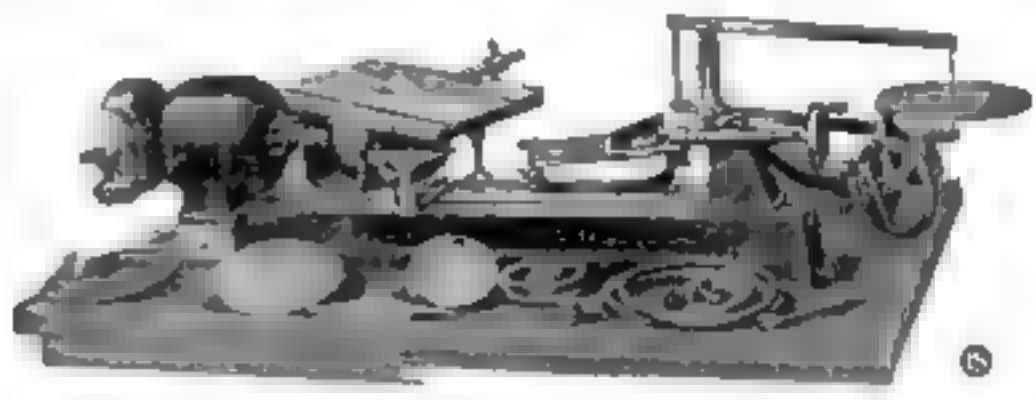


Washer used for fastening a cord.

Make the tie once or twice and you can do it quicker than a cat catches a mouse. To loosen, just pull the rope up and around, and it is instantly ready to go up or down. This makes a tight tie, too. You can break the rope or pull out the nail before it will slip or loosen.—F. B.

YOU CAN BUILD
Worth While Things
ONLY WITH Worth While Tools
AR-CON
UTILITOOL

THE KING OF THEM ALL



Whether your objective is profit, or merely the joy and satisfaction of "making things," the degree in which you realize your aim is dependent directly upon the quality of your workmanship and the ease and speed with which it is accomplished. And these in turn are dependent upon the quality and efficiency of the equipment you have to work with.

The Ar-Con Utilitool was designed to squarely meet the need for a home work-shop that would match the results of commercial equipment—a work-shop built for strength, and accuracy, and durability under constant hard usage. Its sturdy ½ H.P. ball-bearing repulsion-induction type motor—the most efficient type built—provides abundant power for any work the outfit will be called upon to do.

The complete Ar-Con Utilitool consists of a rugged motor-driven lathe with full accessory equipment, including grinding wheel and cotton buffs; a circular saw table; jig and scroll saw; sanding disc and table, and all necessary accessories. Here is a work-shop that will do everything you ask it to do, in the way you want it done.

THE AR-CON TOOL COMPANY
500 Fassett Street - Toledo, Ohio

Easy Terms

Ar-Con Utilitool units may be purchased singly or in any combination of units if the complete outfit is not required at the start. Moreover, the purchase can be made by convenient time payments, if desired. Send for fully illustrated descriptive circular and complete price-list, with terms. The coupon is for your convenience.

The Ar-Con Tool Company
500 Fassett Street, Toledo, Ohio

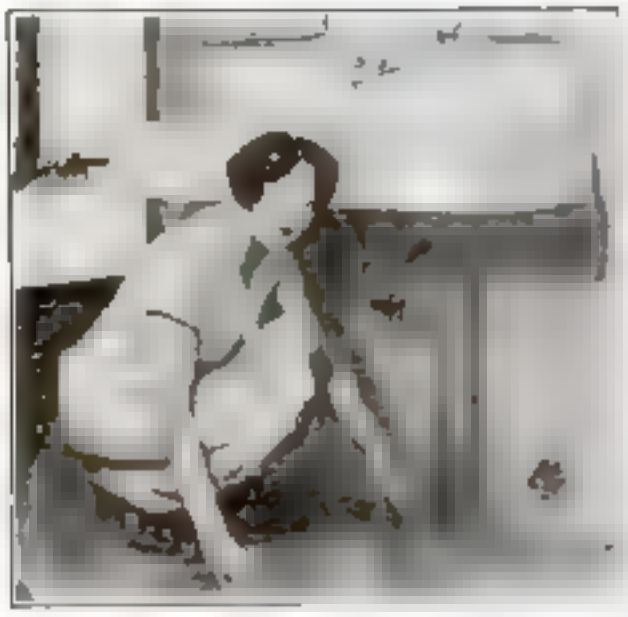
Mail descriptive circular on Ar-Con Utilitool, with prices and terms.

Name

Street Address

City and State

8



Where's the can of

PLASTIC WOOD?

[Reg U. S. Pat. Off.]

Ashes blowing up through open holes—fill the holes with Plastic Wood. Your wife can use your Plastic Wood as well as you for stopping holes, filling cracks, repairing broken furniture, loose handles, and other household depreciation

Real Wood in Putty Form

It is wood, *real wood*, in putty form, that can be moulded in the fingers and hardens into solid lasting wood. It sticks, too, where it is put—to wood, metal, plaster, stone, fabric, even to glass

For Carpenter or Handy-man

Plastic Wood is a prompt for professional and amateur. Carpenters find it often helps to do a better, quicker job. Cabinet makers use it regularly. For the handy man it serves a long felt want, and anyone can use it to "keep his house in order."

It Can Be Worked With Tools

Plastic Wood comes in airtight cans. When hard it can be planed, chiselled, sawed, and holds nails and screws like any natural wood. It is waterproof, and greaseproof, and takes paint, varnish or lacquer perfectly

Plastic Wood Solvent

For thinning Plastic Wood, which may have hardened in the can from frequent opening, cleaning hands or tools, or for softening it when it hardens too rapidly for working, use Plastic Wood Solvent Ask your dealer for it, in 25 and 50 cent cans

PLASTIC WOOD

[Reg U. S. Pat. Off.]

Handles like Putty — *Hardens into Wood*

1 lb. $1.00 — ½ lb. 55 cts.

At Hardware and Paint Stores

ADDISON-LESLIE COMPANY

310 Bolivar Street Canton, Mass.

CHINESE red bookrack sponge stippled with gold and bright green and decorated with transfers.

Novelty Finishes

(Continued from page 66)

modern art, the expression of one's personality is unhampered by precedent or traditions and motifs, while taken largely from nature, are rendered in cubist style, or geometrically, or in other novel ways

The use of "masking tape" often helps in painting modernistic angular ornaments on. The tape temporarily covers portions of the surface to keep them from being coated with the colors you are applying.

Regular masking tape is sold by dealers in the large cities who sell supplies to automobile paint shops. However, gummed craft paper tape used for wrapping packages makes one of the best kinds of masking tape It has a straight edge, is tough and durable, and comes off easily without disfiguring the surface Craft tape can be obtained in cities from large commercial stationers and wholesale paper houses. It comes in various widths and costs little. In smaller towns it usually can be had at some factory or store that uses tape for wrapping

Angular designs of various forms can be produced by pasting strips of tape on the surface so tightly that there will be no opportunity for the paint to run under the edges When the paint has dried, the paper will generally peel off readily, but in case it does stick, it can be soaked off with water

Masking tape also will be found useful for striping borders. Along the edge of the table top or whatever is being decorated, coat a strip about an inch wide with the color desired for the border stripe Then cut a piece of tape the width of the stripe and of the necessary length Cut it with a knife and straightedge to be sure the edges are absolutely straight. Paste this down and then coat the entire surface with the body color When the color is dry, peel off the tape to expose the straight, even stripe of border color.

THE use of gold and silver for edging and others of ornamenting furniture and art objects is effective with any type of decoration. While the most widely used method of gilding is to brush on a mixture of gold bronze powder and a bronzing liquid ("banana oil" or some other type), a much stronger, brighter color with greater depth and richness is obtained by coating the surface with japan gold size, and, as soon as it gets tacky, pouncing on the gold or silver bronze with a chamois or soft cloth. Surplus particles should be blown off.

The very finest gilding, of course, is done with pure gold leaf. This may be applied by the home decorator if done with extreme care, although it is really a job for the skilled craftsman.

Metal leaf, gold and silver, and substitutes for them come in small sheets with thin paper between. The surface to be gilded is coated with japan gold size put on evenly and only where the leaf is to adhere. Necessarily, the size must be applied over a well sealed surface so that it will not soak into the wood.

As soon as the size becomes sticky or tacky to the proper degree, a sheet of the leaf is removed from the box, lifted gently by a corner, and laid on the tacky size. It is then smoothed out with cotton batting and patted down.

Where small or narrow (Continued on page 151)

Model Ships

Mississippi River Steamboat

Build a beautiful model of the Buckeye State with real spun rope, hemp net, rustproof rigging, brass bushed steering wheel, capstan, brass bell and tackle blocks, and all the necessary materials of the finest grade for making decks, [illegible] Price of set, [illegible] $4.95 plus postage for 4 pounds. We also have [illegible] sets for making scale [illegible] Catalog free. [illegible] Mayflower [illegible] $4 and $5 and others. Also sets for [illegible] Revenue racing sail boat. Our small fittings such as blocks, deadeyes, anchors, steering wheels, capstans, guns, etc., are the finest to be had. Latest photographically illustrated booklet contains 48 large pages of useful information and hints in addition to prices for the above articles and special materials, tools, etc., for the model maker A copy will be sent postpaid upon receipt of 15 cents

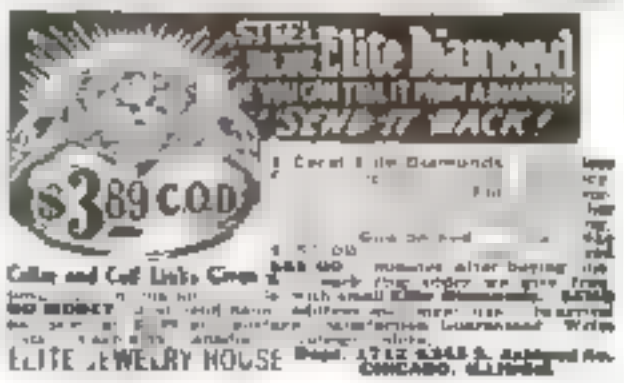
Model Ship Supply, Dept. P, Mineola, N. Y.

only $1.00 DOWN

10 Day FREE Trial

[illegible]

SMITH TYPEWRITER SALES CORP.



[illegible]

Collar and Cuff Links Given [illegible]

GO MERRY [illegible]

ELITE JEWELRY HOUSE [illegible] CHICAGO, ILLINOIS

Novelty Finishes

(Continued from page 150)

surfaces are being gilded, the leaf may be cut to the desired size with a razor blade. Wherever one piece of leaf overlaps another, the laps are allowed to remain until the size has dried hard, when all surplus portions of the leaf are wiped off.

The gilded surfaces, if not to be subjected to much handling or wear, may be left without a protective coating, but if they are to receive any amount of hard wear, they should be coated over with a thin, pale varnish, which may be rubbed with fine pumice stone powder and oil if it is not desired to leave them in a gloss finish.

Among other new finishes are the stippling lacquers recently brought out under various names. Artistic work can be done by stippling them on with a sponge after the piece has been lacquered with a suitable foundation color. Stipple effects are especially suitable for use in panels and surfaces inside of a molding or a border, or for a finish around a panel of ornamental design.

Stippling lacquers usually are furnished in the form of a colored bronze powder and a special liquid preparation in two separate tin

Dusting gold bronzing powder on a jewel box previously coated with japan gold size.

compartments. The bronze powder and liquid are mixed together immediately before use, and only as much should be mixed as will be needed for the work, as the material does not keep well after being combined.

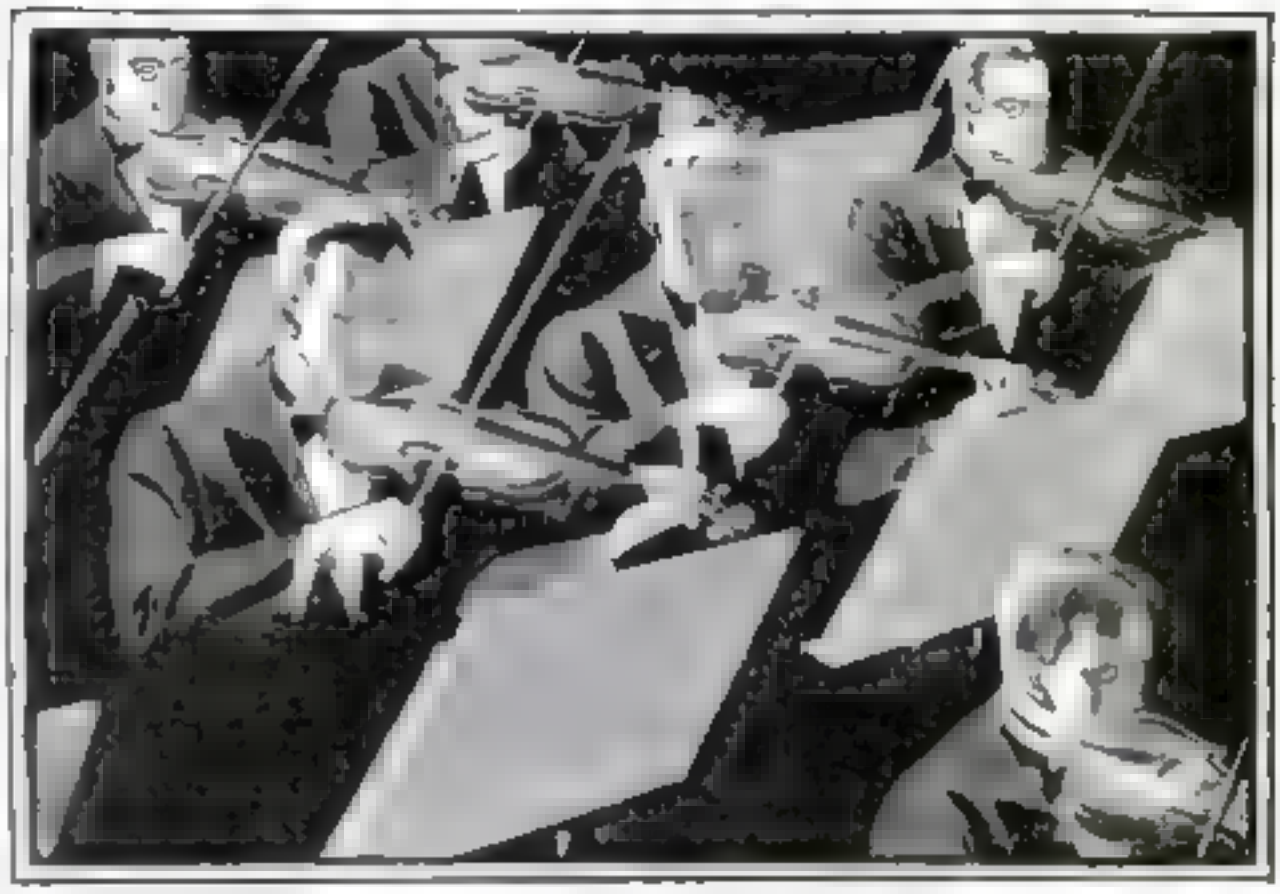
For stippling, use a close-grained sponge. Soften it in water and wring it out practically dry, then dip it, flat side down, into the stippling mixture, which can be poured out on a plate, saucer or even a piece of paper folded to several thicknesses. Tap the sponge a few times on a sheet of paper to remove the excess; then tap it lightly on the surface to be decorated.

It is often desirable to go over the surface two or more times to even up the effect. A second or third stipple color may be applied by cleaning out the sponge with lacquer thinner or using another sponge, and going over the surface again in the same way.

Another type of treatment particularly suited for gift wares is what is generally termed "spatter" finishing. Small spatters of color are flecked onto a plain-color background by dipping a brush into the spatter color, wiping it off on the edge of the container until only scant full, and then striking it against a stick or the back of the hand to jar off countless tiny specks of color onto the surface being decorated.

Two or more spatter colors may be applied, one following the other. A fine or coarse brush may be used, according to the effect desired, and a little practice will soon develop uniform workmanship. One or two strokes should always be made against a sheet of paper or other trial surface to make sure the brush is not too heavily loaded with paint or enamel.

An enamel finish is generally used for the background and enamel (Continued on page 152)



Where working together is everything

An Advertisement of the American Telephone and Telegraph Company

It is the aim of the Bell System that anyone anywhere in the country can pick up a telephone and talk to anyone anywhere else clearly and without delay. That is the meaning of universal service. To provide it, the means of telephoning must be uniformly good. Each of the 24 operating companies of the Bell System has full access to all the improvements and methods that are continually being made.

There are 5000 workers on the staffs of the American Telephone and Telegraph Company and the Bell Laboratories whose sole occupation is to develop constantly improving methods and equipment for the 350,000 employees of the Bell System to use in serving the public. The results of the efforts are evident, not only in the extension of telephone service across the Atlantic, but in the constantly improving local and long distance service at home.

The very nature of the telephone business necessitates a single interconnected system. The American Telephone and Telegraph Company accepts its responsibility for a nation-wide telephone service as a public trust.

It is fundamental in the policy of the Company that all earnings after regular dividends and a surplus for financial security be used to give more and better service to the public.

A definite program for getting ahead financially will be found on page four of this issue.

$25

A Ring You Will Be Proud to Wear

SEND NO MONEY

Genuine Full Cut Diamonds—No Chips

No. 648

Terms(8 mos. to pay) Ask for Free Jewelry Catalog

Buffalo Jewelry Mfg. Co. "The Mail Order Jewelers"
Dept. A (or at your Jeweler's)
201 Washington St. Buffalo, N. Y.

Exact size of ring

$24

AERO KITS

You Can Build Better Than You Can Buy

AERO "CHRONOPHASE"

The Aero "CHRONOPHASE" principle is Radio Frequency Amplification in the first outstanding development to broadcast reception since the introduction of the neutrodyne. Now selectivity takes on new meaning, for sets employing this principle can be made so selective that even the side bands of local broadcast stations can be cut off. Greater sensitivity range also is achieved with remarkable smoothness of control. No factory-built set has the new and revolutionary "CHRONOPHASE" principle. It may be had, however.

In Three Wonderful Receivers

The 1929 six-tube Aerodyne, the Aero "Eleven-Twenty-Nine" and the five-tube Aero CHRONOPHASE, in the upper are the CHRONOPHASE circuit. Complete kits for these receivers may be had from your dealer. No expense has been spared in endeavor to make these kits the finest you can buy. A beautiful, genuine period cabinet is a part of each kit. Every part needed for the construction of the receiver is included, even wire, soldering tape and wood screws so that nothing more need be purchased. Anyone can assemble an Aero receiver in a few hours; panels are drilled, which insures proper placement of parts and full-size pictorial wiring illustrations eliminate mistakes in wiring. Aero sets can be built for A.C., D.C., or Shield Grid tubes.

A postcard request brings new catalog for August 1st describing the new 1929 Aero Aerodyne and describing the 64 page Aero Dream Book for 1929. Send it.

AERO PRODUCTS
INCORPORATED

Dept. 1598 4611 Ravenswood Ave. Chicago, Ill.

Novelty Finishes

(Continued from page 131)

of a harmonizing or contrasting color for the spatter work. The spatter color should be thinned a little. If applied while the foundation coat is still wet, the spatters will sink level with the surface, but if the ground coat has become dry, they will be on top of the surface in a raised or pebbled effect.

Polychroming, or the partial wiping off of color applied over a foundation coating of another color, is especially adapted for gift wares, but it is so well known that it will not be described here.

Another novelty treatment that produces a remarkable blending of colors is as follows: Fill a deep dish with water and drop a little of each of three or four colors of enamel on the surface of the water. Run them together somewhat with a spoon or small paddle to form a pattern like marble.

The object to be decorated, as for instance the candlestick in the upper illustration on page 58, is then let down into the water by means of a wire loop, and pulled up slowly through the film of enamel floating on top of the water. This coats the surface with a finish of unusual beauty.

With a few practice dippings, anyone can get the knack of the operation. Unsatisfactory attempts can be wiped off with gasoline. After being dipped, the object should be allowed to drip and dry. Suspend it over a newspaper by means of a hook formed on the other end of the loop of wire.

Shellac Protects Book Bindings from Wear

A GOOD method to protect the binding of books is to apply a coat of white shellac, 1 or 2 small, soft brush, and coat the covers evenly. The shellac does not harm the binding or obscure the title and other lettering.

Dust and dirt may be wiped from the treated binding with a slightly damp cloth. If necessary, the finish may be renewed again if the first coat of shellac wears off in places under constant use.

It pays to treat scientific text and reference books by this method, as they are expensive and are often placed on open shelves where they are exposed to dust and sometimes to chemical vapors.

I have seen books, after receiving this treatment, placed in a public library with other books that were not shellac coated. After a few months the value of the protective coating became very evident.—RALPH R. LA COMPTE.

Keeping Brakes Adjusted

IF AUTOMOBILE brake drums are scored badly, it is folly to expect them to stay in adjustment. The drum should be removed and reground or replaced with a new one.

Difficulty in adjusting brakes may be caused by grease and dirt, which sometimes will get into the brake lining and rot it. Water will put some linings out of commission as long as they remain soaking wet. It occasionally happens, too, that the brake drum is out of round and wears the lining away as fast as it is set up.

When going over a set of brakes, disconnect the pull rods and set up the hands to the drums until there is .015 in. clearance between the lining and the drum at all points. Then set up the pull rods for the proper leverage and throw of the pedal. The job then will have every chance of staying right provided the linings are good and the drums in satisfactory condition.

See that the spring-to-axle clips are tight and make certain that there is no motion back and forth on the spring saddle.—RAY F. KUHN.

A Lifetime of Popularity Musical Joy Extra Money

DON'T YOU, like everyone else, want all the fun, profit and popularity you can get out of life? Where will you find more *fun* than in being able to create your own music? Or more *profit* than in being able to make $5 to $25 a night for work that is "play"? Or more *popularity* than in being able to "dash off" a snappy fox trot, a dreamy waltz or stirring march on your xylorimba?

Joy and Pleasure Ahead

Imagine long, cheery evenings at home or with sweetheart, wife or friends. Picture yourself the center of interest wherever you go—looked up to as the fellow or girl who plays the xylorimba. A whole *lifetime* of musical joy and all that it means. Don't these thoughts appeal? You can make them come true!

Start to Play Very First Day

Remarkable the Xylorimba is, *it is the easiest of all instruments to play.* No tiresome practice. No teacher. No finger or lip exercises. You begin to play at once. Soon you amaze friends and relatives with expert xylorimba selections. Xylorimbists are always in demand at dances, parties, theatres and radio studios and well paid for the entertainment they furnish. As a step to that you are always able to make substantial spare time money.

Plays 20 Minutes, Gets $20

Ralph Smith, Chicago, played 20 minutes at a wedding and got $20.00. Although only two in Clark Wallace, Jr. plays big time vaudeville exclusively. Harry Breuer, New York, has made hundreds of friends through his xylorimba selections. Writing, L. F. Hallman, Reading, Pa., writes: "Made $300 in five weeks' spare time."

Free Trial—A Year to Pay!

As the world's largest manufacturers of xylophone instruments, we don't want you to invest in a xylorimba unless you are sure it is all we claim for it. For five days you try the instrument of your choice in your home. You pay for it only if entirely satisfied, then in such easy installments that they are never missed.

Big Book Free! On receipt of the coupon we will send you *absolutely free* the Big Deagan Book that tells you all about the Deagan instruments, the free trial offer, the easy payment plan, the simple lessons, the artists who use Deagan Xylorimbas and the big money that they are making. This book is yours without cost or obligation. Delay has killed so many opportunities that we urge you to send in the coupon TODAY!

MAIL COUPON TODAY!

J. C. Deagan, Inc., Dept. 1659, 1770 Berteau Ave., Chicago
Send me, without obligation, full details of Free Trial offer and easy payment plan on the Deagan Xylorimba.

Name _____

Address _____

Clamps for Speedy Work

(Continued from page 89)

has to be frequently tightened and loosened.

Few mechanics think of providing any means on duplicate jobs for holding a clamp in position when loosened. Yet even on many a single-piece job it is worth while to devise some method for accomplishing this purpose. In Fig. 11 at *A* is shown a counternut, and at *B*, a stiff, short coil spring, either of which answers the purpose without in any way interfering with the work. The spring can be used almost anywhere, no matter whether the bolt is inclined or not, or how close the stem is to the work, provided a washer is placed against each end. The spring also allows instant adjustment of the clamp in any direction, while preventing it from dropping or shifting in any way unless intended. Either expedient—counternut or spring—will be found a great improvement where a difficult job of clamping has to be repeated several times.

A POINT often altogether overlooked is some form of bolt that can be applied without the tedious job of screwing a nut on or off every time. Such an article, made from a carriage bolt, is shown in Fig. 12 at *A* and *B*. All that is necessary is to grind off the round head flush with the flats on two opposite sides of the shank. Except for heavy jobs, such a bolt has ample strength. If the bolt is used with a slotted strap, the nut need never be removed, unless a counternut is to be used with it. You will find frequent use for this kind of quick-action bolt once you have a few on hand. Incidentally, this bolt not only saves the trouble and time of removing and replacing—and hunting for—the nut and washer, but also prevents the stem from turning while the nut is being tightened.

The cap screw of Fig. 13 at *A* and the nut at *B* are designed to prevent the nuisance of one part's turning while the other is being tightened. One or the other is used together with a plain nut or screw. As in the case of the quick-action bolt, it is necessary to choose for this service a screw that nicely fits the slots in the machine table or faceplate, in order that a sufficient bearing surface is left.

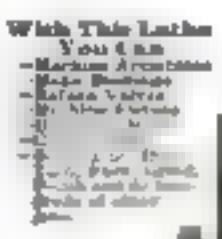
WE WILL now turn our attention to a few simple designs of clamps that can be made at very small trouble in even the smallest shop. Variety is essential in a collection of clamps, because of the many conditions that have to be met. C-clamps are not ordinarily used, except for holding work on the drill table, yet the smaller sizes of these clamps, which can be bought for ten or fifteen cents almost anywhere, can be put to excellent use on the faceplate in holding light work, especially for grinding. The frame should preferably be of such cross section as to allow the clamp to be turned in the slots sufficiently to obtain a full footing, as at *A*, Fig. 14, although it is possible to use a bar underneath across the slot, as at *B*.

Perhaps the main reason why C-clamps are not used on the faceplate is the projecting end of the screw, which would interfere with the headstock if placed on the inside of the faceplate, and constitute a danger if it were to stick out in front. With a very little work, this trouble can be remedied by shortening the screws of several similar C-clamps by various amounts as shown in Fig. 15. Since the thickness of the faceplate or drill table must be subtracted in every case, this amount, plus a small allowance for the thinnest work that is likely to turn up, is taken off from the longest screw. Two or three additional sizes are prepared, differing, say, by ⅛ or ¼ in., according to the size of the lathe or drill press. The handle is removed, and the head of the screw turned down almost to the cross hole. With a set of clamps so fixed, the greatest free projection of the screw of the 3-in. clamp shown is but slight. At the expenditure of

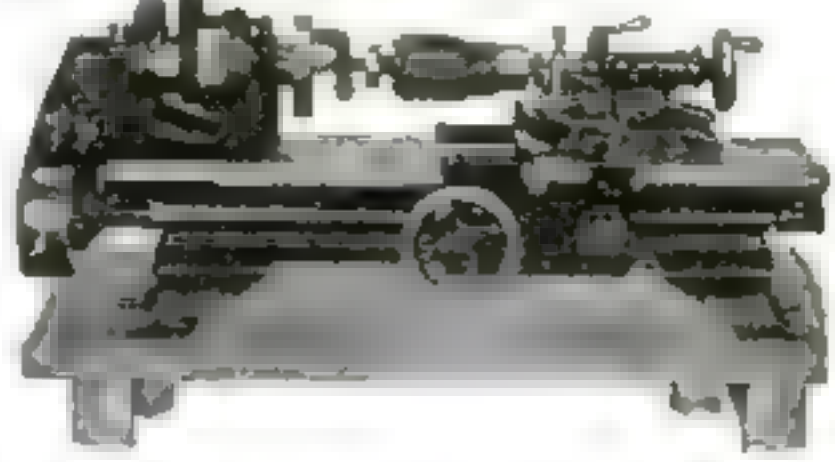
(Continued on page 134)

Only $150

—and Easy Payments If Desired



Here is the greatest Lathe Value ever offered. A Universal Tool of highest quality and accuracy one that will work metals of all kinds—cast iron, wrought iron, steel, aluminum, brass, bronze, copper, monometal—also fibre, hard rubber, and wood in pattern making. Note the many kinds of work it will do.



SOUTH BEND LATHE
No. 22

Specifications:
9¾" x 2½' Back-Geared Screw Cutting, swing over bed, 9¾"; distance between centers 16½"; width of belt cone drive, 1"; length of bed, 2½ ft. Power required, ¼ h. p., shipping wgt., 350 lbs.

Complete Book of Instructions Sent Free with Each Lathe

It is as easy to learn how to run a Lathe as to learn to run a car. The operator soon becomes proficient, especially if mechanically inclined. With each South Bend Lathe, we send most complete book of instructions telling just how to do all kinds of work on the Lathe.

Illustration above shows South Bend Lathe No. 22 complete with Disk Drive, very compact Bench Outfit. Plugs in a light socket for Power.

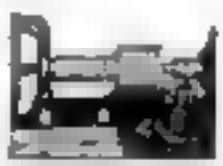
Easy Payments!

If you prefer, you can order any South Bend Lathe and pay for it out of income instead of capital. Write for free Catalog and Bulletin No. 23, which tells all about this unusual South Bend Lathe now priced at only $150. South Bend Lathes are also made in larger sizes from 11" swing to 24" swing.

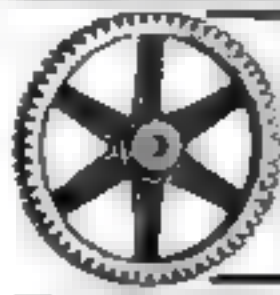
SOUTH BEND LATHE WORKS
857 E. Madison Street South Bend, Ind., U. S. A.
New York City: J. E. Rogers Co., 111 Centre Street
Carried in stock by Machinery Supply Dealers in Principal Cities throughout the World


Electrical Work


Piston Work


Cutting Threads

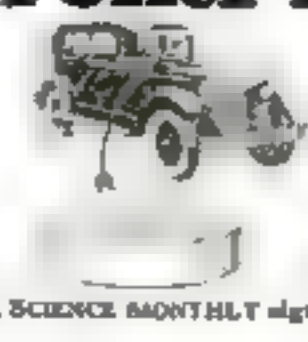
Gentlemen: I would like your net factory price on a South Bend Lathe for ☐ Manufacturing ☐ Machine Shop ☐ Garage Work. Outside Lathe also ☐ Please send Free Catalog No. 23. ☐ Check kind of work.
SOUTH BEND LATHE WORKS, 857 E. Madison Street, South Bend, Ind., U. S. A.
Name .....
Address .....
City ..... State .....



GEARS
All Kinds-Small
The most accurate made and prices reasonable. We have a wonderful line of gears in stock for home shop equipment. Can also quote on special gears of all kinds. Send us your inquiries.
Write for Catalogue 214
CHICAGO STOCK GEAR WORKS
325 South Jefferson Street Chicago

BURN YOUR NAME ON TOOLS
WITH THE
ARKOGRAF
Protect Your
Tools From Theft. Write with electricity any name or design on the hardest and most tempered tools and instruments or any metal. Like writing on paper with pen of point. Complete Outfit $3.50 Prepaid Anywhere. Interesting circulars and details free. Write today. Agents wanted.
ARKOGRAF Pen Co.
2172-A East Burnside St., Portland, Oregon

I Offer You $60 a Week-*Steady*



Pocket big daily profits taking orders for No-Frost—the amazing new preparation that keeps rain, snow, frost, mist and steam off auto windshields, show windows, mirrors, etc. Auto owners, bus drivers, store keepers, housewives buy on sight. Be your own boss. Work when you feel like it—full or spare time—and make $15 to $60 a week—steadily and sure. Wonderful new money-making opportunity everywhere.

ANYONE—ANYWHERE—CAN MAKE BIG MONEY

No capital or experience needed! We furnish everything. Earnings start at once. Don't miss this chance. Write quick for Profit Sharing Offer. AMERICAN PRODUCTS CO., 8360 MONMOUTH AVE., CINCINNATI, OHIO.

Write for this book!

80-Page Manual Tells How to Build 4 NEW HI-Q RECEIVERS AND SAVE MONEY!

WRITE TODAY for the biggest and most complete Construction Manual ever published on the famous Hi-Q RECEIVER, the CUSTOM-BUILT circuit designed by the engineers of America's foremost radio parts manufacturers.

80 pages of text, photographs and diagrams on how to build the New Hi-Q Receivers — Junior Hi-Q 20 at $14.45; Junior All-Wave Hi-Q 20 at $19.95; Master Hi-Q 20 at $30.50 and the Master All-Wave Hi-Q 20 at $31.95. Each of these new receivers is a distinct achievement over any Hi-Q receiver of the past 4 years — each is a completely changed "exact-to-copy" instrument — each is a marvel in selectivity and sensitivity — each has even finer tone than any of the famous Hi-Q instruments of the past. And each can be built by following the simple directions in the Hi-Q Manual, at SAVINGS of $50 to $100 over any ready-made receiver of anything like similar efficiency.

This New Manual also covers power amplifiers, public address, short wave adapters, installation, high efficiency battery and code practice sets, antenna noise reducing and a wealth of other practical information.

Makes you handy to build a fine radio for yourself AT A SAVING and now build for others AT A PROFIT.

Send 25 cents for your copy before first edition is exhausted.

Hammarlund Roberts Custom Built Radio

Hammarlund-Roberts, Inc.,
103 U Broadway, New York, N. Y.

I enclose 25 cents for the new Hi-Q Construction Manual. Please send it at once.

Name

Address

City & State.

Clamps for Speedy Work

Continued from page 133

a dollar and a few odd moments in the shop, a set of eight or ten clamps can be made that will give speed and added convenience on many jobs of light turning and grinding.

The self-adjusting clamp strap illustrated in Fig. 16 at *A* is specifically intended for work where the surfaces which must be held are slanting or uneven, as at *B*, but has points about it which make it excellently suited to all-around work. It is an ordinary strap with a steel ball forced into a hole made in one end. The universal capacity of this clamp adapts it for holding rough castings and makes it independent of the exact height of the blocking. It should be used with a block having a hole to give a seat for the ball and prevent the sudden sliding and dropping of the block, which is a nuisance in adjusting work on the faceplate.

The more elaborate offset forms of clamps are best bought ready-made, especially in the larger sizes, unless the mechanic has the skill and equipment required to forge them.

A FEW designs of flat clamps, which can be made without much trouble from cold-rolled steel by shaping or milling, are shown in Fig. 17. The shorter ends may be made in the form of a stock, as at *D*, which is then cut to make the individual bars. At *E* is illustrated an offset design. Note that the front corner is turned out to a semicircle to allow getting closer to round work. A self-adjusting type is shown at *H*. The design at *C* is well adapted for narrow places. Properly overhardened, a set of these straps in lengths of up to six or eight inches forms a neat and useful addition to the equipment of a bench lathe or small drill.

We will conclude with a low headroom clamp, which, though there is no frequent call for it, will be found handy at times. A screw with the head countersunk is used with almost any of the styles described. One kind is shown at *I* in Fig. 18, while at *H* is illustrated an instance of its application in a part having an overhanging flange. An ordinary V-head screw may be used, although a ball headed screw and a semi-spherical nut as shown will add the advantage of making the clamp self-adjusting. Such a clamp, of course, requires to be tightened always from the back or underside of the faceplate or drill table. Because of the practical lack of any projection, whether below or above, this clamp will work in places where no other clamp will, and is safe at high speeds.

This is the first of a series of articles on easier and better ways to hold work in the machine shop.

Stenciling Christmas Cards

Continued from page 132

thick and not too wet. Any stiff bristle brush may be used to apply them. A regular stencil brush may be bought for the work, but even a flat paint brush works very well if a rubber band is placed about the bristles to keep them from spreading.

The position of the brush is shown in an illustration on page 92. The motion should always be up and down in a vertical direction. If the different parts of the stencil are of the same size, they may be each laid down in turn, the color applied, and the completed design made up one card at a time.

Sometimes after a number of impressions have been made from one of the smaller stencil sheets, it becomes clogged and filled up. If show card color has been used, such a stencil may be cleaned by scraping it with a knife.

In the case of some of the smaller and simpler parts, it will be found easier to add eyes and other small dots of color with the tip of a brush than to cut a stencil for them.

Remember in the selection of colors for Christmas cards that bright, cheerful hues are always the ones to use.

Make the Harmonica YOUR "Musical Pal"

MILLIONS of boys and girls have found the harmonica a most delightful "pal" for their hours of leisure and have discovered that it greatly increases their popularity among their friends.

It is so easy to play this instrument that in a short time anyone can render correctly not only the beloved melodies of school and camp, but also the latest popular songs fresh from Broadway.

Unless you can play the harmonica, you are not keeping up with the times. *Today is the day to get started.* In a short time you will play as well as the next "fellow."

Send now for the free instruction book offered below. You will be amazed and delighted at the ease with which you can master the simple fundamentals and the quickness with which you will be ready to play favorite selections.

If you have already acquired the "knack" of playing, carry your recreation enjoyment further by learning to perform on the famous "Chromonica." This is the only harmonica which includes the half tones and thus enables you to play any and every selection in any scale.

* * * *

Ask your teacher, club leader or Scoutmaster to help you start a harmonica band. Tell them to write for our special brochure, giving full directions for this work. This is sent only to adults in authority.

M. HOHNER, Inc., 114 East 16th St. Dept. 504 M NEW YORK

Grand Prize Awarded HOHNER HARMONICAS At Niagara Centennial Exposition, 1936

FREE

INSTRUCTION book, fully illustrated. Use the coupon to ask for it.

HOHNER Harmonicas

M. HOHNER Inc
114 E. 16th St., Dept. 504 M New York

Please send free Instruction Book

Name

Address

Making Your Car Better

[Illegible] (Continued from page 110)

the rainy season. It is a 6,000-mile journey through miles of knee-deep water in crocodile-infested bogs, through blistering heat, blinding sandstorms, and rivers swollen by flood. Yet through this wilderness ploughed two Chevrolets—a standard sedan and a truck—to reach Cairo, in 135 days, en route to Stockholm, Sweden. Meanwhile, over another 8,500-mile route, a Chrysler driver forced his stock sedan in the amazing time of ninety-four days—also at the height of the wet season.

Some idea of the trials these men experienced, and that their cars weathered, may be gleaned from the Chevrolets crossing of the Ruvu River, in Tanganyika Territory. It was in full flood when the expedition reached it—five miles wide, in many places, and waist deep. For three days the adventurers sat and waited for it to go down. Instead, it rose five inches. Then they decided to go through. First went the sedan, a hundred natives dragging it by main force. Then the truck on pontoons—but the pontoons sank in mid-river, and natives with ropes towed the half-submerged vehicle through the swamp and up on the other side. Despite the advice of well-wishers, both cars completed the trip without recourse at any time to boats or train "portages."

SUCH feats are not the result of chance. Modern autos have stamina bred into them, at factories where the real boss, whose word is respected and feared, is the man at the proving grounds.

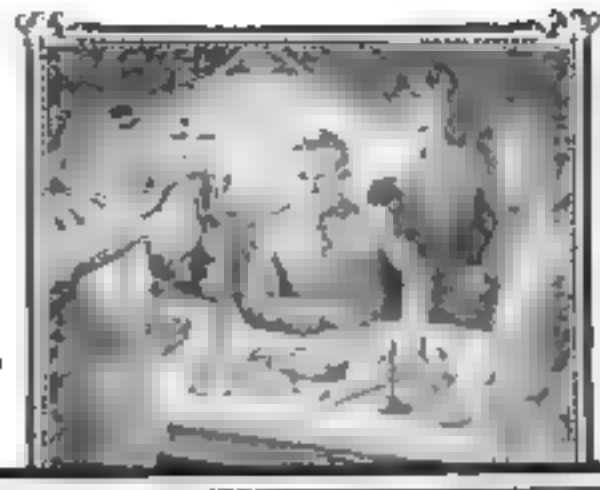
At these great outdoor laboratories, a new car model must prove its worth in gruelling tests. Up and down hills it bucks the roughest treatment a hardened driver can give it. It is raced at top speed for hours around a concrete oval, while checkers measure its performance with stop watches and chronometers accurate to the veriest fraction of a second. No seasoned testers take its wheel, but handy men whose notion of good driving is simplicity itself—"open 'er up and hold 'er to the road until something gives way."

That so few things do give way is amazing. For instance, when a car is moving at a hundred miles an hour, the motor is turning up about 4,400 revolutions a minute, and the actual travel of a piston is almost incredible. It starts—attains a speed of sixty miles an hour—and stops short, all in 1/140 of a second, or 8,400 times a minute. In the same unbelievably brief split second, a valve opens, gulps in a charge of gasoline vapor, and shuts again. And the flywheel is the speed king of the car's machinery parts; its circumference is spinning at 171 miles an hour.

FIGURES that take your breath away? Imagine, then, what was going on inside one of the Studebaker engines in the 50,000-mile run described at the beginning of this article. Each piston traveled 49,087,000 feet, not smoothly but at a banging, jolting gait of stopping and starting that you might expect would tear it to pieces at every stroke. More than 269,000,000 explosions bathed the inside of every car's engine with white-hot fire. Every valve sprang open and clamped shut 33,060,000 times. Every crank shaft made nearly seventy million complete revolutions!

To build an auto that will weather strains and stresses such as these, the motor car maker of today keeps many of the cars that he manufactures to try them for himself. A surprising proportion of the country's total auto mileage is run off by machines the public never sees. Cadillac and La Salle cars at the proving grounds, in two years, covered 1,215,000 miles—more than five times the distance to the moon. Oldsmobile test cars, used in designing a new model, ground out 1,177,000 miles, a distance that the aver- (Continued on page 136)

There's no fun like Chemistry!



REGISTERED TRADE MARK
CHEMCRAFT
THE CHEMICAL OUTFIT

Be a Boy Chemist!

Work Wonderful Chemical Experiments in Your Own Laboratory—Start Your Own Chemistry Club—Astonish Your Friends with Marvelous Chemical Tricks!

CHEMICAL experimenting is the finest fun you ever had. You can make magic of ink and paint—cut your hair with salt, cloth and metals amaze—do things and see what they are made of—perform chemical tricks and surprise your friends. These are only a few of the things you can do with a CHEMCRAFT outfit. There is no limit. Imagination can't run out new experiments of your own and find out different tests all the time.

These new CHEMCRAFT outfits are the finest ever made—larger with more chemicals and apparatus, more and better experiments. CHEMCRAFT outfits are the original chemical toy sets—the most accurate and most safe. Get one this Christmas and start the most interesting thing you ever did!

CHEMCRAFT No. 1 ... Price $1.00

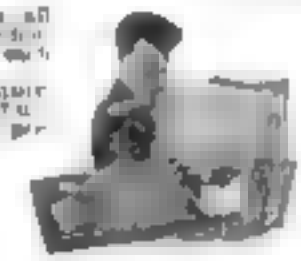
CHEMCRAFT No. 2 ... Price $2.25

CHEMCRAFT No. 3 ... Price $4.00

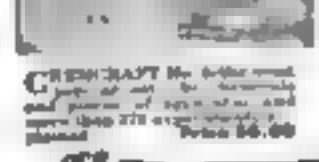
Seven Wonderful Outfits—Select Yours Now!

Each is complete with safe chemicals, all apparatus and the Manual of Instruction. Liberal quantities of chemicals permit many experiments over and over again. Each CHEMCRAFT is sent by parcel post to any boy anywhere in the U.S. or Canada, postpaid, upon receipt of price. If not satisfactory, we will refund your money.

The PORTER CHEMICAL COMPANY
115 Summit Avenue, Hagerstown, Maryland

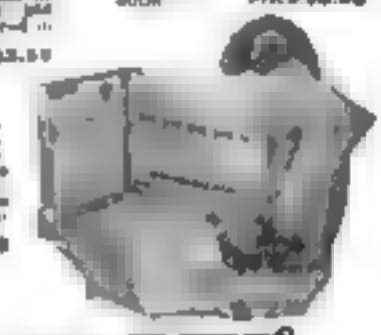


CHEMCRAFT No. 4 ... Price $3.50



CHEMCRAFT No. 5 ... Price $6.00

CHEMCRAFT No. 6 ... Price $15.00



Try Chemistry With This "JUNIOR" Set!

Only 25c Postpaid

CHEMCRAFT Laboratory ... Price $35.00

FREE Magazine for Boys! Full of exciting news, experiments, models and Chemcraft Club news. Tells about Chemcraft outfits for boys and girls. It's FREE! Just write for it.

Sport Bodies for Fords at FACTORY PRICES!

This Model for Ford Cars Only $38.50 Prepaid

Write for Booklet A 10 Showing This and Other Models.

SPORT FACTORIES, Aurora, Illinois

SPEEDSTER AIRPLANE

It's a beauty! Wing spread, 24½ inches long, wood propeller spins when launched. A real flyer that climbs from the ground and speeds loops, dives, glides through the air. Comes to you all assembled. Only 50 cents postpaid.

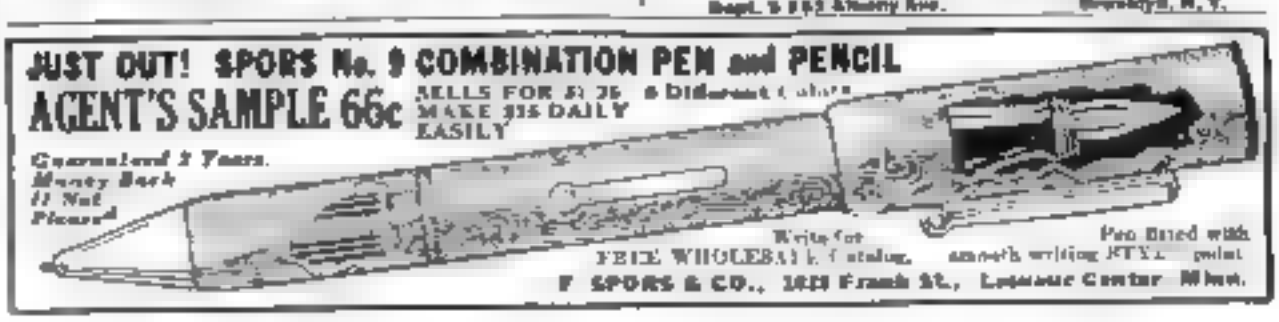
SPEEDO-PLANE FLYER

Runs from the ground. Soars to great heights and glides perfectly to the ground. Has wing spread of 16 inches, length 14 inches. Each set is carefully machined wood propeller. Sketch of performance sent. Just the plane. Fully assembled. 50 cents postpaid. Postmaster's money refunded. Sent on money refunded.

SPEEDO MANUFACTURING COMPANY
Dept. 5 182 Ainsley Ave. Brooklyn, N. Y.

JUST OUT! SPORS No. 9 COMBINATION PEN and PENCIL
AGENT'S SAMPLE 66c SELLS FOR $1.25 MAKE $15 DAILY EASILY

Guaranteed 2 Years. Money Back If Not Pleased



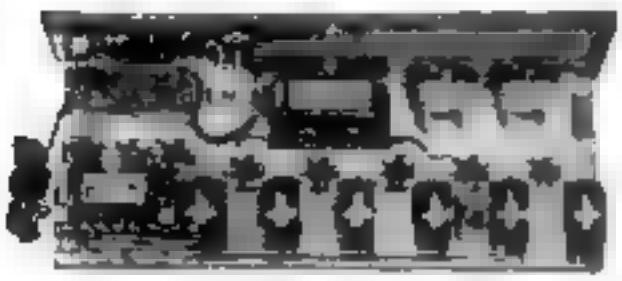
Write for FREE WHOLESALE Catalog. Pen Inked with smooth writing STYLO point.

F SPORS & CO., 1621 Frank St., Lasalle Center Minn.

Until you have heard the

NEW VICTOREEN

You cannot realize the marvelous developement in Radio Reception



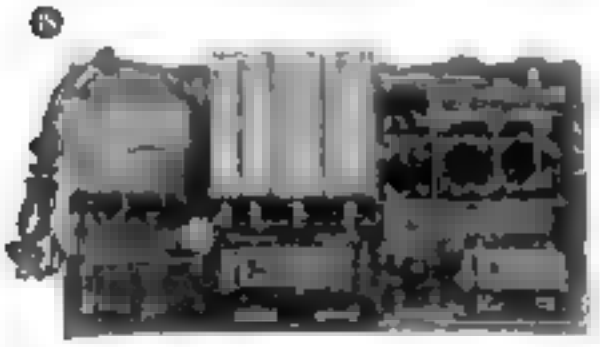
The new Victoreen is simply wonderful—that is the only way to describe it. It has *wonderful* tone—*wonderful* selectivity, *wonderful* sensitivity. It is *wonderfully* simple to assemble, *wonderfully* easy to operate. Anyone who has the slightest "knack" can assemble in a few pleasant hours a set which, from every standpoint, simply cannot be surpassed.

This is a season of wonderful radio programs. With a Victoreen you can enjoy them from coast to coast. If a Victoreen can't "get" a station it can't be had.

Victoreen R. F. Transformers have been greatly improved—the circuit has been still further developed—many other radical improvements have been made which make Victoreen more than ever, the world's standard "Super."

Write for the complete Victoreen story and the *FREE Blue Print* giving constructional data and full directions. You'll have a set that you can boast about, when you have a Victoreen.

The Blue Print is FREE



Victoreen Power Amplifier & "B" Supply

makes any good set better

Supplies 45, 90, 180 and 440 volts, using a UX 210 or 250 in the last stage. Contains two voltage regulator tubes so that the 90 and 180 volt taps are supplied with a constant volt potential. It is the last word in "B" supply. For the most satisfactory results you must have it.

Free Blue Print, with list of parts and complete assembly instructions, will be sent upon request.

The Geo. W. Walker Company

Merchandisers of Victoreen Radio Products

2825 Chester Ave., Cleveland, Ohio.

Victoreen

Quality Radio Parts

Making Your Car Better

(Continued from page 135)

age owner might take 146 years to cover.

Even when the model is passed, and placed on sale, the makers are not satisfied. Many a car is bought from a dealer ostensibly by a private individual, just as you or I might buy it, and driven back to the factory or entered in a race to see what it can do.

Stock car races are the final test of the factory's effort to build a staunch and powerful vehicle. Competition is keen, and the American Automobile Association rigidly examines each competing car to be sure that it is the same as the one in the dealer's window. When a sedan model can run all day and all night at sixty-eight miles an hour, with only one minute's average time out every hour for stops that include re-fueling and changing drivers—as a stock Buick did to win a recent Indianapolis race—then the maker is satisfied that he has a car able to stand abuse.

No wonder, then, that the 1929 models you see in the showrooms have the sinews of titans under their glistening paint, and the strength of a Hercules beneath the engine's hood. That is what Mr. Driver demands today, and thanks to such tests, he is getting it.

You Can See Your Home Before You Build It

(Continued from page 57)

their roofs are lifted one may see rooms and halls and even furniture. They are lighted by electricity so that you can look through their mica windowpanes. You can easily imagine yourself as living in these tiny habitations. Having everything before you like this is far better than puzzling over a blueprint where a square is a "library" or "master bedroom."

Probably everyone who has built a house has forgotten some comfort and convenience. He may have thought he told the architect or misread the plans. Let him see standing walls and partitions and closets all clearly modeled and he knows what he is getting. The wife can tell how many steps it will be from the kitchen to the dining room, and whether the bathrooms and the kitchen sink are right. There is little danger of doors being forgotten or the windows omitted when all the arrangements of the house unbuilt are so indicated.

Many persons blame architects and building contractors when they are charged for changes made after plans are drawn or construction begun. They do not realize that changes require that plans be redrawn and scores of measurements revised. Shifting pipes after a building is well up may mean tearing away walls at a heavy cost.

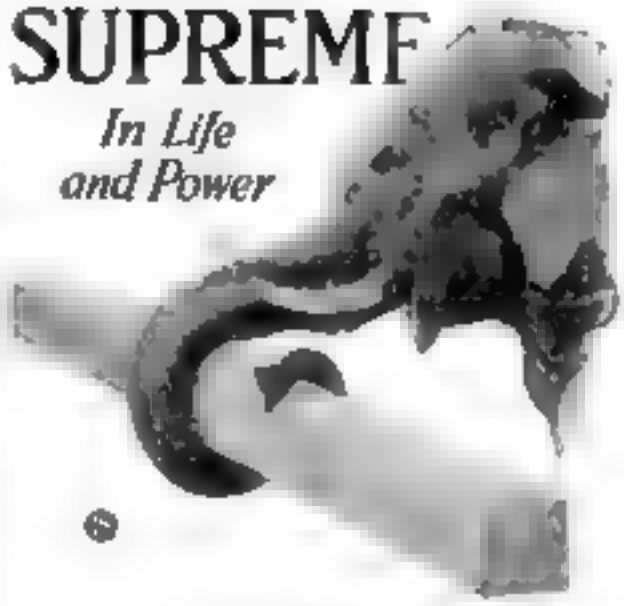
A model fully worked out, however, permits the owner to see just what his new home will be, if the scheme indicated is carried to completion. If he wants changes, they can be made with scissors or knife at no expense.

If you are thinking of having a home built and have your lot, and are not quite ready to go ahead, you can take many a delightful excursion into the future by trying your hand as an amateur model maker. The materials such as cardboard, thin wooden strips, and sculptor's clay (plastoline) are cheap and the tools required are few and simple. Also, you can have models made to suit you at relatively small cost. If you are a camera enthusiast you can see the results of your labor on the site proposed, when the time comes. You thus can work out very definite ideas on which architect and builder can go ahead to make your dream of a dwelling come true.

It has been said nobody knows whether he likes his new house, its settings, or its interior until he has lived in it a year. If one have the foresight to study it in a small edition, he can read his title clear to comfort and content.

SUPREME

In Life and Power



Burgess "Super B" Batteries have larger cells than standard batteries. Extra power and life are thus provided. Uniformity is insured by scientific precision in manufacture. Radio's cost is lowered appreciably by the use of "Super B" No. 22308, a medium size heavy-duty 45-volt battery, designed for general, all around use . . . or "Super B" No. 21308, the largest size Burgess heavy-duty 45-volt battery, made especially for heavy-current consuming sets.

Chrome

Chrome is a preservative that guards power when your Burgess Battery is not in use. Burgess engineers solved the secret of utilizing it in battery construction. It is a patented feature that justifies the preference of thousands for Burgess Batteries for all purposes.

BURGESS BATTERY COMPANY

General Sales Offices: CHICAGO

In Canada, Niagara Falls *and* Winnipeg

BURGESS "SUPER B" BATTERIES

Mechanical Men—Our New Slaves

(Continued from page 75

Wensley s Televox, as the name indicates, is a mechanism which can be operated by a voice from a distance The control of mechanism from afar by means of electrical circuits is a familiar operation. A very faint electrical impulse will affect an electromagnet which, by moving its armature over a small distance, can be made to release energies waiting for the signal to get into action. Such an impulse may be conveyed either by direct wires, as in the case of the Edison "robot" plant, or by wireless. Thus boats have been steered without a pilot, automobiles driven safely through traffic without a human driver, and even airplanes flown without an aviator at the control lever!

These feats, however, have been mere demonstrations of possibilities. For general industrial application they are, as yet, too expensive and too uncertain. Wireless cannot be relied upon to work perfectly at all times, and the cost of setting up and maintaining a wire circuit over any considerable distance, where it is used only occasionally, is prohibitive

BUT telephone wires go almost everywhere! And in the Televox, Wensley solved the engineering problem of utilizing the vibrations of the human voice transmitted electrically over a telephone wire, and exploiting their power at the receiving end to produce oscillations in an electrical circuit

And now three of these robots, stationed at three reservoirs which hold the water supply of the city of Washington, report to their chiefs in the War Department, whenever called upon to do so, the depth of the water in their respective reservoirs.

In the same city is the "Great Brass Brain" of the Coast and Geodetic Survey, and it is surely one of the most useful robots in existence. To it every day men put questions about the future, which it answers with such precision that tens of thousands risk their lives and untold millions of wealth are staked upon the accuracy of its forecasts. It predicts the tides for every port in the world for years ahead.

The Great Brass Brain is a form of harmonic analyzer, operating mechanically instead of electrically It occupies a space eleven feet long, six feet high, and two feet wide, and does without error labor which otherwise would require fifty to one hundred human computers, working continuously and subject to the inevitable percentage of human errors.

HAVE your thinking done while you wait! The Product Integraph of Doctor Bush of the Massachusetts Institute of Technology is a robot performing this startling function. Where workers in the business world ordinarily are satisfied with addition, subtraction, multiplication, and division of numbers, the engineer deals with curves and graphs which represent for him the past, present, and future of the things in which he deals. In other words, whereas the ordinary adding and calculating machines are limited to handling definite numbers, or constants, the new invention deals with those indefinite and inconstant quantities known as variables. These are quantities whose changing values depend on other variable quantities.

Strange to say, the mechanical brain of the Integraph, which solves in a few minutes problems so complex that it would take an engineer from a month to a year to work them out, resembles nothing so much as the electric meter in your home It performs its thinking processes and reaches its solutions by running as a motor, translating the problem into terms of electric power and expressing the answer in the same manner.

And so the age of (Continued on page 150)

PUT THIS WORKSHOP IN YOUR HOME FREE For 10 Days-No Deposit!

A New and Improved Workshop

Here is a workshop built to a standard of perfection accurate in operation most durable in construction easy to operate. It is absolutely dependable and will withstand severe constant service Try it for ten days at our expense and you will be convinced of its superiority.

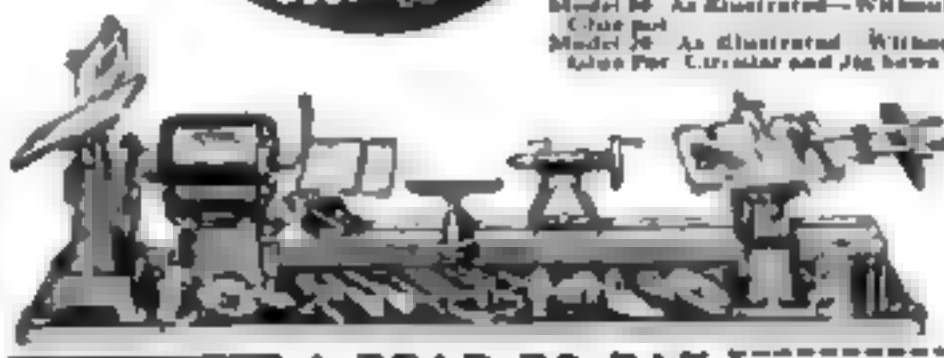
Suitable for Carpenters, Home Workers, Pattern Makers, etc.

Furniture manufacturers use MAC, THE POPULAR MECHANIC Workshop, for making furniture models. Manual Art Schools use it for instruction. Home workers use it for pleasure and profit Carpenters use it for making repair parts, spindles, chair legs, cabinets. It is ideal for making all kinds of furniture.

An Unusual Price For Such a Sturdy, Complete Workshop

MAC, THE POPULAR MECHANIC, represents the utmost in value and dependability Now you can have an accurate, practical workshop at a big saving. Once you use MAC you will be convinced of its superior qualities. That's why we want you to try it for ten days at our expense.

Model 70 As Illustrated $125.00
Model 80 As Illustrated—Without Drill or Chuck Set $105.00
Model 70 As Illustrated Without Drill, Grinder and Jig Saws $75.00



12 MONTHS TO PAY -NO MONEY DOWN!

Model No. 70

Weight 410 lbs. Motor 4 H. P. Motor A. C. Standard Plan Chuck Set Jig Saw Attachment Drill Attachment Emery Wheel Attachment Grinder Attachment Belt Sander Attachment Lathe Attachment Rip Saw Attachment Scroll Saw Attachment Circular Saw Attachment Jig Saw Attachment Belt & Disc Sander Attachment Drill Chuck Arbor and Flange Set Buffing & Polishing Brushes Emery Wheel Adjustable Tool Rest and Tool Supports with Rod Clamp Tool Turning Tools and Socket Wrenches.

A YEAR TO PAY

MAC The Popular Mechanic Workshop may be purchased as low as $5.45 per month within the reach of anyone You use it as you pay

Send No Money We will send this shop to you on ten days free trial. If you decide to keep MAC send a small first payment. If not send it back to us and there will be no charge on your part We offer no more liberal terms and nothing but MAC is the greatest value ever offered!

Send the Coupon Now Right now before it slips from mind send the coupon! Tear Out Coupon Now! Write for MAC literature You take no chances whatever in sending for MAC remember MAC is guaranteed to please you or your money back It pays to Send Coupon Now!

Dealers Write for our Proposition!

MIDLAND APPLIANCE CORPORATION,
210 S. Michigan Ave., Dept. 820,
Chicago, Ill.

Kindly send literature with full particulars of your unusual No-Deposit Trial Offer Also tell me about your low prices and easy payment plan

☐ Send Model No.____. I will try it for 10 Days and if I decide to keep it, agree to remit in accordance with your terms.

Name_____

Address_____

City_____ State_____

How to Work with Tools and Wood

This book explains in a simple straightforward manner all the processes of working with tools and wood. It tells all the necessary part of using tools and machines and is profusely illustrated and gives helpful hints to every home workshop. All details are clearly explained.

Price $1.60

POPULAR SCIENCE MONTHLY
239 Fourth Avenue New York City

CONTROL

Prevent the ups and downs of your tubes. Install AMPERITES the simplest control that keeps voltage constant. AMPERITES insure long tube life and better receptions. A type for every tube battery or A. C.

$1.10 with order (in U.S.A.) Radiall Company

FREE Use "Amperites" Blue Book of radio receivers and battery connections. Write Dept. P. S. 20

AMPERITE
The "SELF-ADJUSTING" Rheostat

SANTA MARIA
Size—6 in. wide, 10 in. high, 2 in. wide

CHARMING UNUSUAL

Make Them For Your Friends—Cash In On

Big Profits

It's easy to make a SANTA MARIA or MAYFLOWER model sailing ship to ornament a Den, Room, Desk or Parlor Shelf

HULL IS COMPLETELY ASSEMBLED, READY TO RIG AND PAINT ALL SAILS, SHIELDS AND FLAGS FULLY PICTURED. DECORATED IN BEAUTIFUL COLORS.

Complete instructions furnished, also colored picture to enable you to finish it correctly

This one of its kind made No carpenter work necessary Nothing to mit out. Everything complete can be finished in a few hours' excellent pastime.

$4.45

Plus a small parcel post charge. Send check or money order and mention ship you desire Entire satisfaction guaranteed.

GIFT CRAFTERS 1427 Moncher & Turner Sts. Philadelphia, Pa.

The
Best in Controls!

TONATROL
Trade-Mark
Complete Line of Volume Controls

Tonatrol offers you the simple, positive and efficient means of volume and sensitivity control. A type especially designed for your circuit, with or without battery or power switch as desired, $1.50 to $3.00.

TRUVOLT
All-Wire Resistances

Remarkably accurate and dependable due to unique, air-cooled design. Truvolt Variables are potentiometer type, eliminating difficult calculations and permitting easy adjustment to receivers and tubes. 22 stock types, $3.50 each.

Truvolt Fixed Resistances are adjustable to any set values desired by the use of sliding clip taps. Made in all desirable resistance values and current ratings.

Electrad specializes in a full line of Controls for all Radio Purposes including Television. Write for Free Circulars and Full Information.

Dept. S-12, 175 Varick Street, New York.

ELECTRAD INC.

Mechanical Men—Our New Slaves

(Continued from page 137)

the robot is now really upon us. Perhaps Karel Capek, in surveying the modern industrial scene, is more surprised than any of us by the manner in which his fanciful prediction, in a sense, has come true!

But the robots of his play were very different from the obedient, useful mannequins described here. Docile slaves of man at first, they finally rose in revolt against their masters and exterminated humanity, subsequently perishing themselves, since they had no power of reproduction and wore out in time, like any other piece of machinery.

Such a disastrous development is, of course, out of the question in the case of the robots of science. But—will they ever become so perfected and will their numbers so increase that they will destroy the necessity for human labor?

In the light of present knowledge, that seems not at all likely. A writer of philosophic tales once told of a man who gradually grew crazier and crazier tending one of those intricate mathematical machines and hoping each day that his mechanical servant would make a mistake.

MANY years went by and his hopes remained unrealized. Every sum was fatally right. Finally, the catastrophe came. A cog or two flew out, and the machine reported automatically a whole series of results most gratifyingly erroneous. The machine had gone completely crazy first! Maybe it is one of the eternal verities that machine thinking makes no small mistakes, but only big ones!

Then, too, consider that the robot cannot work without human direction and control. Eric's life-giving levers are set in motion by a man pushing buttons. The stroller in London's West End could never walk alone. Televox answers the phone only when called upon to do so by Wensley or someone else equally acquainted with his inner workings. Without the lone operator at his board three miles away, the robot army in the Edison plant would have perpetual leisure!

Thus, while the events foreshadowed in R. U. R. have come to pass in a measure, a realization of the dream of thinking machines is nowhere within the range of actual possibility.

WHAT, then, does this interesting development really mean to all of us? Does it mean that, before long, most of the work of the world will be done by robots? Will the man of affairs soon go to his office in an automobile driven by a mechanical chauffeur, who will be directed at busy intersections (and perchance "bawled out, too") by a mechanical traffic cop? Will that same business man, at lunch time, be waited on by a robot waiter and, in the evening, be guided to his theater seat by a robot usher? Will his wife have a mechanical ladies' maid to "hook her up in back" and his children a robot nurse to wash their morning faces and take them to school?

Perhaps. But in any event the robot and his development on a large and scientific scale will result in at least one great benefit to mankind. In the words of a high official of the New York Edison Company, "the mechanical man and his ultimate universal practical application will rid humanity of much drudgery and thousands of uncongenial tasks."

Men thus freed from unpleasant chores, he declared, never need fear unemployment in a well-organized society but, on the contrary, may look forward to a better opportunity for the development of their inherent talents and intellectual powers. They will receive the gift of leisure, which will enable them to apply their released energies to the achievement of a finer, fuller life than they can enjoy at present.

Genuine Diamonds Guaranteed — *"Diamonds Win Hearts"*

DIAMONDS-WATCHES
CASH OR CREDIT

Give your sweetheart a Diamond ring from Loftis! We import our Diamonds direct from Europe—finest quality sparkling, blue white Gems of fiery redness. All mountings of exceptional beauty—14-k White Gold pierced and engraved. Our prices defy competition! *Satisfaction guaranteed or money back.*

Send for Free 132 Page Catalog. Shows over 2000 amazing bargains in Diamonds, Watches and Jewelry.

Credit Terms: Pay one-tenth down; balance in weekly, semi-monthly, or monthly terms at your convenience. All goods delivered on first payment.

$55 Ladies' White Gold Wrist Watch

Railroad Watches—Guaranteed to Pass Inspection

WEDDING RINGS

The Old Reliable Credit Jewelers — LOFTIS BROS. & CO. — DEPT. S-621 108 North State St. Chicago, Ill.

AIRPLANE

MANN & BENTON Sole Distributors, Cincinnati, Ohio

Carter

A. C. Set Outlet Plate

PROVIDES ground and A. C. outlet for power current together with jacks for aerial and lead-in. Now being used by leading architects and contractors in homes and buildings. One in your home will be a revelation to you. Three finishes: Lacquered Brass, Brown Bakelite, Statuary Bronze. An ideal A. C. set installation.

Any dealer can supply

Write for catalog of world's largest and most complete line of Radio Parts

Carter Radio Co. Chicago

"The Majority's Choice"

Risk Death for Invention

(Continued from page 61)

Now Momsen gambled his life that it would work at great depths. First, with volunteers who also donned the masks, he descended sixty feet into the Potomac in a diving bell, slid into the water, and ascended safely along a rope. Next, off Dahlgren, Va., he and Chief Gunner's Mate Thomas Eadie, hero of the submarine *S-4* rescue attempt, repeated the test successfully from a depth of 100 feet.

Finally Momsen and two other men threw caution to the winds and had themselves lowered in a diving bell from the salvage vessel *Falcon* 155 feet straight down into the waters of the Chesapeake Bay, off Solomon's Island, Md. None had ever attempted to emerge from such a depth without heavy metal armor; for all they knew, it was certain suicide. At the top of the rope, watchers waited anxiously the outcome of the experiment.

THE waters parted, and the head of Lieutenant Momsen emerged. A few seconds apart, Joseph Eaton, chief torpedoman, and E. Kalonowski appeared from the depths, all clad in Momsen's weird masks. They were safe; and though the bodies of all three were bloated from their sudden release from undersea pressure, none felt serious ill effects.

Now it was certain that the Momsen lung would be a life-saver in almost any submarine disaster. Recalling a few submarine catastrophes of the past, the *S-5* sank in 102 feet of water, the *S-51* in 130, and the *F-4* in 305. Momsen and his fellows had demonstrated the effectiveness of their device to 165 feet. New tests in the Navy air tank confirmed it to 225. Navy men believe that it could even have saved the occupants of the *F-4*.

From these tests has evolved the "lung" as it appears today—a mouthpiece with a bag of oxygen attached. Regulators adjust the pressure of the gas supply automatically for any depth. Weighing only two pounds, the lungs can conveniently be carried on a submarine—one for every man—where cumbersome safety apparatus is out of the question. Officials who watched the tests characterize the device as the most practical rescue implement yet invented.

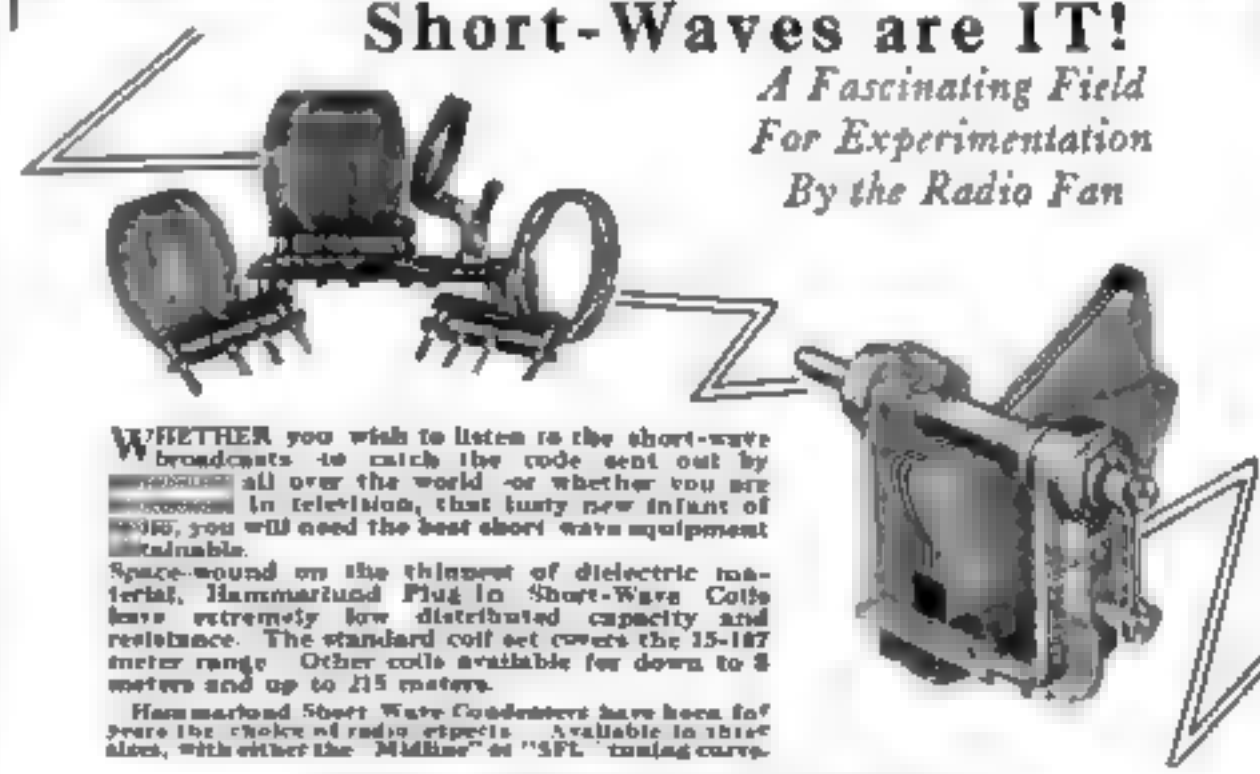
AT THIS writing the Navy was preparing another spectacular test of the lung—to reenact the *S-4* disaster. Six or eight daring volunteers, including Lieut. Momsen, were to man the raised and reconditioned *S-4* off Hampton Roads, Va. The ill-starred submarine, with them in it, was to be sent to the bottom. Then several of them, wearing Momsen lungs, would attempt to escape to the surface.

Two other methods of submarine escape were to be tried at the same time. One, the new Navy diving bell pictured last month in POPULAR SCIENCE MONTHLY, is designed to be bolted to a hatch of modern construction on the submarine while the crew escape into it and are hauled to the surface.

The other is an amazing rescue submarine designed by Simon Lake, pioneer undersea boat inventor. It has wheels on its keel, windows in its bottom, and a compartment at the bow through which divers can emerge and rescued men enter at the bottom of the sea. For the test Lake remodeled his early craft *Defender* and planned to pilot it alongside the sunken *S-4* to take a part in the dramatic rescue.

Here again the Momsen lung would play a vital part. Men equipped with the device, leaving the *S-4* through its hatches, would troop along the sea bottom to the *Defender* and would enter the rescue submarine's double lock doors to be borne to the surface.

That was to be the last act of a stirring drama of courage and self-sacrifice—of Navy men willing to risk even death that their comrades undersea might live.



Melodies Caught in Flight with

Cunningham RADIO TUBES

As the Yule-logs crackle and music fills the air, enjoy the Christmas melodies to their utmost by having new Cunningham Radio Tubes in every socket of your Radio.

These "ambassadors of joy" make delightful Christmas gifts.

E. T. CUNNINGHAM, Inc.

New York Chicago San Francisco

Manufactured and sold under radio patents and all other patents and rights owned by Radio Corporation of America.

Making a Television Disk

(Continued from page 53)

the compass to the width of the picture, and with the hinge of the compass pointing directly at the center of the circle, find the point where the compass legs will touch adjacent radii. Use one of these points as the start of your spiral. These steps are illustrated at the top of page fifty-three.

A perfect spiral can be drawn by using a stud at the center with a piece of thin piano wire wound around it. The scriber should be passed through a loop in the end of the wire. As the scriber moves around, the wire winds about the stud and gradually draws the point toward the center, or unwinds and allows it to approach the rim, depending on which way the wire is wound around the stud.

The diameter of the stud should be equal to the height of the picture divided by 3.1416.

BEFORE you start to lay out the spirals on the metal, remember extreme accuracy is essential. See that you have plenty of light, use a sharp pointed scriber, and be careful that each punch mark exactly coincides with the spiral line. Also make sure the disk is mounted on the shaft of the motor so that the center of the motor shaft matches the center from which you laid out the spiral. The size of the hole in the center of the disk will depend on the diameter of the motor shaft.

A thin sheet of polished aluminum will do well for the television disk. The shiny surface will clearly show the lines scratched on it with the sharp steel point.

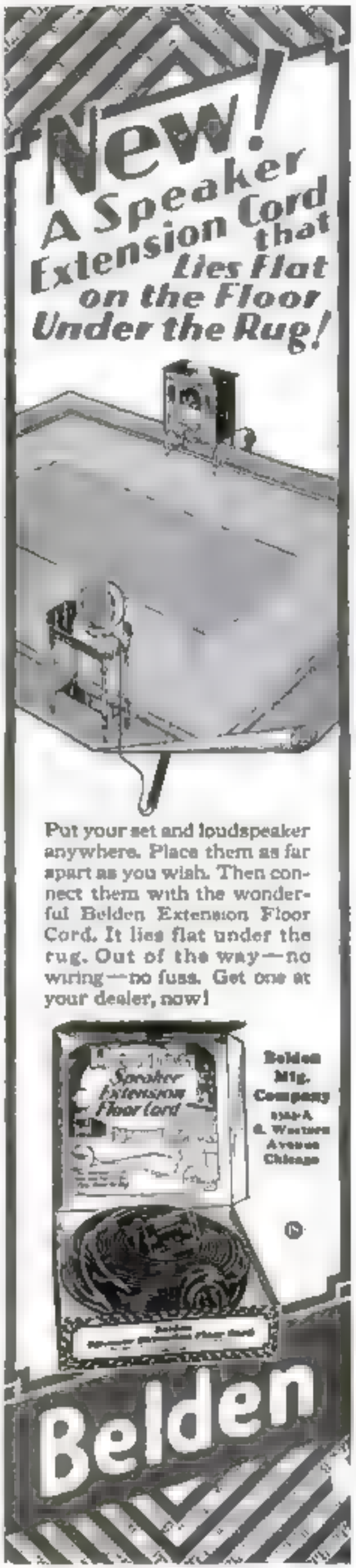
The diagrams show the principle of laying out a spiral. The same method should be followed no matter how many holes are to be used, or what size the picture is to be.

Now let us see how it works out in practice. Suppose, for instance, that you have a sheet of aluminum not less than twenty-four inches square and that you want to lay out on the one disk spirals for forty-eight, thirty-six and twenty-four hole pictures, and that you have a neon tube with a plate large enough to illuminate a picture one and a half inches square. With such definite specifications, it is possible to calculate many of the dimensions.

THE outer hole of the forty-eight-hole spiral will be exactly 11.46 inches from the center of the disk. The outer hole of the thirty-six-hole spiral will be 8.60 inches from the center and the outer hole of the twenty-four-hole spiral will be 5.74 inches. The diameter of the stud about which the wire is wound will be ⅜ inch. The same stud is used for all three spirals.

The holes are drilled in the disk at the intersections of the spiral with the radii. The size of these holes is determined by the number of holes in the spiral and the height of the picture. To find the size of the hole, divide the height of the picture by the number of holes and add ten percent to provide the necessary overlap. For the particular disk mentioned above, the holes in the forty-eight-hole spiral should be drilled with a No. 66 drill (drills smaller than No. 00 can be obtained in a jeweler's supply store). Drill the holes in the thirty-six-hole spiral with a No. 56 drill. Use a No. 50 drill for the twenty-four-hole spiral. It is desirable to drill the holes with a drill a couple of sizes smaller than specified, and then redrill with the right size to get the holes exactly right. Be sure to remove all burrs.

BEGINNING next month the first complete story of the two brothers who gave us the airplane, written from new sources of information. Watch for it!



This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Use Durhams as

Grid Leaks
Voltage Dividers
Detector Tap Resistors
Resistance Coupling
Battery Eliminators
TELEVISION

Wherever Non-Inductive Non-Capacitative Pure Path of Resistance is a Vital Factor! whether in factory-made or custom-built radio receivers, whether in battery eliminator circuits, whether in power amplifiers or in television circuits—DURHAM Resistors, Powerohms and Grid Suppressors are the first choice of men who seek first quality results. DURHAM Powerohms are recommended for use in the sensitive resistance-coupled amplifiers in the photo-electric cell circuit of Television apparatus. They are specified in the popular Cooley Rayo-Photo Equipment. They are used by the U. S. Government and by such experienced organizations as General Electric, Western Electric, Westinghouse, Stewart-Warner, Bell Laboratories, and practically every important radio service station and experimental laboratory in the country. Made in all ranges for every practical equipment. Follow the lead of the leaders in radio and tie-up to DURHAMS—radio's leading resistance units.

DURHAM METALLIZED
Resistors & Powerohms
INTERNATIONAL RESISTANCE CO.
2006 Chestnut Street, Philadelphia, Pa.

Can *Your* Car Stand the Cold?

(Continued from page 70)

the bottles had sprung a leak. You should have seen his expression after he'd ordered me to stop and sniffed out where the smell came from!"

"That," commented Gus as the laughter subsided, "explains what's the matter with alcohol. It's a perfectly good antifreeze only it won't stay put. What you need is something that is equally noncorrosive and yet won't boil away. Glycerin and ethylene glycol are the only two that will do the trick. There really isn't any choice between them. They both cost a lot more than alcohol, but you more than make up the difference by using the same solution winter after winter if you don't lose it on the road through leaks in the cooling system. I'll go over yours to see that it's tight."

"How about the lubrication?" Timothy inquired. "I have been informed that special oil must be used in winter."

"That's true enough if you let the motor run cold all the time," Gus replied, "but if you keep the motor at summer temperature there's no reason why you shouldn't use the same grade of oil all the year round. Of course, if you keep your car in an unheated garage you want to let it warm up before you drive it out. And run it slow while it's getting warm. Racing a cold motor is the worst thing you can do.

"THE transmission and rear end," Gus continued, "ought to be filled with a lighter grease or oil in winter than in summer. That's particularly important if grease is used, because a stiff grease may get so hard that the gears just cut grooves in it, and besides, you have a lot of trouble shifting speeds.

"You want to watch out for your storage battery, too. It won't freeze if you keep it fully charged, but a nearly exhausted battery will freeze and be ruined if a cold snap hits it. I'll set your generator so it shoves more juice through the battery. Don't add water except just before you go out for a drive. The jiggling around will mix it with the solution before it gets a chance to freeze."

"My gracious!" exclaimed Timothy. "I didn't realize it could be so simple. Just a few easy precautions and I can enjoy my car in winter without hurting it."

"That's what it amounts to," Gus agreed. "Remember to use high grade gas so the motor will start easy, and don't forget to carry tire chains with you all the time. You never can tell when you're going to get caught in a snowstorm or a sleet storm, which is even worse."

"ARE any of these car heaters satisfactory?" Timothy inquired. "If they are, I could get along without a heavy overcoat and thick gloves."

"Most of the good makes are all right if they are installed carefully," Gus replied. "But don't go sailing off without an overcoat. A friend of mine did that once in the middle of winter with the temperature down below freezing. About four miles from nowhere, the motor quit the job and the poor boob had to hoof it in that weather without any overcoat or gloves. He nigh near got pneumonia."

Speedy Travel by Air Express

AS AN example of the speed and convenience of modern air travel, great Fokker planes of the Western Air Express regularly whisk passengers between San Francisco and Los Angeles in three hours' time, either way. Train time for the same trip is thirteen hours.

Luncheon is served in the air to passengers; and, at the terminals, buses meet all planes. Service is twice daily.

TELEVISION is now an accomplished fact.

Experimenters will welcome the Raytheon Kino-Lamp, the first television tube developed commercially to work with any system.

Uniform glow over the entire plate, without the use of mirrors or ground glass, gives it perfect reproduction qualities.

Kino-Lamp is the latest achievement of the Raytheon Laboratories which have made so many original contributions to radio science. List Price $7.50.

Write for information
RAYTHEON MFG. COMPANY
Cambridge, Mass.

{Raytheon} Foto-Cell

Available in both *hard vacuum* and *gas filled* extra sensitive types, each in two sizes. Write us for special specifications.

Raytheon
KINO-LAMP

Money Making Opportunities
for Readers of Popular Science Monthly

Rates 40 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the February, 1929 issue should be received by December 5th. Submit details of proposition with order.

Advertising

GET into Advertising. Learn quickly at home. No previous experience unnecessary. New easy plan. No text books used. Practical work. Be established several years. Send name and address for interesting free booklet. Page-Davis School of Advertising, Dept. 174-B, 3601 Michigan, Chicago.

Advertising Services

24 Weeklies 13¢ rural weeklies, 24 dailies. Ad-Mayer, 471 3rd Ave., New York City.

A. A. A. anyone should not be without the important factor in Money Making. Write today for the Quick Action Ad-writing Rate Folder, which contains information of value to you. If you are desirous of quick profit returns do it now. Address your inquiry to Manager Classified Advertising, Popular Science Monthly, 242 Fourth Ave., New York.

Authors—Manuscripts

MEN, BEST stories wanted by publishers. Address manuscript to Author Service Dept. 7, Box 14, Harrisburg, Pa.

MANUSCRIPTS wanted. Stories, articles, short poems. Western Syndicate, Hannibal, Missouri.

Aviation

THE American School of Aviation announces a new correspondence course in Mechanics of Aviation. A thorough training in Practical Aeronautics. American School of Aviation, Dept. 6741, 3601 Michigan Ave., Chicago, Illinois.

BIG 64-page Book Catalog Model Airplanes, Parts, Supplies, 5¢ postpaid. Lloyd Company, 31 West 19th Street, New York.

BALSA of model aeroplane material. Various sizes, spool, reels, bamboo, rubber band. Also circulars on free three foot plans. All for three cents. Aero Shop, 3048 Northern Ave., Detroit, Mich.

MODEL Air Motor Co., Auburn, Mass. Send 3 cents for supply booklet.

LEARN aviation and soaring. Build your glider complete plans and parts. Send 10¢ for further information. Hyde Glider, 1731 Alfred Way, Milwaukee, Wis.

Skyward Ho! Wonder book on aviation. 72 pages, 300 illustrations, shows complete training for flying career. Parts, Personnel. Ben Free. Write today. Parks Air College, 3 Lindbergh Field, St. Louis, Mo.

INSURE PLANS to advertise yours. A well-defended profit from your advertising. Write today for a copy of the Quick Action Advertising Rate Folder showing How You Can Use Popular Science Monthly Profitably. Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

Bending Machines

THE famous Pexto "Wonderbend" (all steel from end to end) sheet metal bending machine. Bends metal right in the exact angle or position. Bends up to 2 feet of 16 gauge pipe read. Thousands in use by all classes of trade from the smallest shops to the largest railroad systems. Write for circular and prices. Pexto Co., 1161 Pexto Bldg., Ft. Dodge, Iowa.

Blue Prints

FOR THE man who has a Home Workshop and likes to work with tools. Popular Science Monthly offers the opportunity to purchase blue prints of the details of the many articles of useful or play for the home. The following are a few of the blue prints available: No. 10, Workshop Bench. No. 11, Cedar and Mahogany Chest. No. 41, Blue Print Radio Set. No. 42, Radio Receiver with three stages of amplification. No. 43, Two Tube Radio Set. 44 and 45, Model Plane Ship. 46 and 47, Spanish Galleon. 48, Model Sailing Yacht. No. 50, A plane model. 51, 52 and 53, Clipper Ship. 54 and 55, Sloop Radio set. 57, Model Submarine. 58, 59, 60, Clipper Ship Model. 61, Model Airplane. 62, Clipper Ship Model. 67, Toy Model of Lindbergh's New York-Paris Plane. 68, Flying Model Type of Lindbergh's Monoplane. 70 and 71, Pioneer Radio Cabinet. 74, 75 and 76, Santa Maria Ship Model. 78, Temple Treasure. Sets 43, 44 and 45, Mayflower Model. 87, Sampler Model. Write for Simple Schematic Wiring and Hookups. 10-in. Wooden Scale Flying Model. Type. Send 25c for each blue print you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

BLUE Print Boat Plans. 10¢ dealer. C. W. Wolfe, 67 Berley St., Rhinebeck, N. Y.

Books and Periodicals

WHAT the Radio Buyer should know. A 24 page booklet with full information on selecting and operating. Price 25 cents. Popular Science Institute, 250 Fourth Ave., New York.

SPANISH Magazines, Art Publications in French, English, Spanish. Photo novelties, samples, etc. Data, 20 cents stamps. Villaverde Co., Dept. 205, Box 870, Havana, Cuba.

To sell by most booksellers, or sent postpaid on receipt of $3.50. 4th edition. Radio Theory and Operating, by Mary Texanna, 500 pages, 400 illustrations used by over all radio schools and many colleges. Laurel Publishing Company, Dept. 21, Washington, D. C.

SELL ADVERTISER. Ask today for a copy of the Quick Action Advertising Rate Folder. It contains some mail-pulling facts which will prove interesting and valuable to you. Also tells How You can use Popular Science Monthly Profitably. Would like to know which one you. Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

Business Opportunities

LEARN the collection business. Good income quickly realized in spare time. Write for interesting booklet. Nat'l Collection Association, National Collector's Association, Science Building, Newark, Ohio.

BECOME a Foot Correctionist. A New Profession that doctors are encouraging. All the trade you can attend to. Many are making $3,000 to $5,000 yearly. Easy terms for training by mail. No further capital needed or goods to buy. No agency or soliciting. Address Stephenson Laboratory, 9 Pleasant Bay, Boston, Mass.

EARN money at home; actual courses sold on re-purchase basis. Also rented and exchanged. Money-back guarantee. Catalog free. (Courses bought.) Lee Mountain Supply, Alabama.

INVENTIONS commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

Profits With Your Own Products. Make them yourself. Formulas, Processes, Trade Secrets. All lines. Catalog, circulars free. C. Thasly Co., Washington, D. C.

Millions Not Realized at Home. Costs Less 4 cents per square foot, you charge 7½ cents. Immense profits, plating any objects. Reflectors, tableware, stoves, refrigerators, or almost anything. Outfits furnished. Write, Sprinkle Plater 94, Marion, Indiana.

Your Advertisement may make you Thousands of Dollars. If you'll write immediately for my Free Opening Literature describing successful Formulas, Valuable Trade Processes, Money Making Information and how to easily make the World's Best-Selling Specialties. All Kinds. Have never been equalled. Profit enormously. Start in your Home. Hundreds of Men Make the Good Money you're entitled to. Dr. Alexander Miller, Chemist, Tampa, Florida.

Dies and Machines, Industrial, Miniature. Special jobs. Keep, Erie, Pa.

$25 A business starts home spare time. Men and women make $25 to $100 weekly operating a New System Directory. Ready for you. Unusual opportunity. Complete outfit furnished. Only a few dollars required to begin. Write for big free book. Take hold. W. Hillyer Ragsdale, Drawer 19, East Orange, N. J.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the Quick Action Ad-writing Rate Folder showing How You Can Use Popular Science Monthly Profitably. Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

$1 PHOTOS from 24 negatives brought $1,134.84; Complete plan $1.00. Dale Van Horn, 648 Federal, Fremont, Nebr.

SIGNS, Showcards Easily Painted with Letter Patterns. Large assortment of Alphabets and Signs. Samples for Stamp. John Hahn, 811 N. 20th, Omaha, Nebraska.

Cartoonists

AMATEUR Cartoonists: Sell your cartoons. New plan. Smith's Service, P.S.1194, Wenatchee, Wash.

Chalk Talks

LATTER projecting stereopticon, $7.50. Catalog free. Cartoonist Nabs, Oshkosh, Wisconsin.

Chemicals

CATALOG, listing 2,000 illustrated chemicals, supplies, 1000 chemicals, 100 recipes, formulas sent for 10c. Laboratory Materials Company, 941 East 71st St., Chicago.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the Quick Action Ad-writing Rate Folder showing How You Can Use Popular Science Monthly Profitably. Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

District Managers Wanted

WE START you in a protected business of your own, $100 to $200 weekly easily made. We buy capital or finance you as agency. New introduction plan. Unlimited managers, local or traveling, for new serial message instruction. Enormous demand and profits. Few dollars for equipment starts you. For particulars, write quick to Messenger Company, 687 Boylston St., Boston, Mass.

Dogs, Birds, Fish

REGISTERED registered bull pups. $15. Bulldogs, 903 Rockwood, Dallas, Texas.

Education and Instruction

DON'T prepare for any Civil Service examination without seeing our free catalogue. Columbian Correspondence College, Washington, D. C.

LEARN at home bookkeeping, mastered in 90 hours with keys guaranteed diploma. International Bookkeeping Institute, Desk 10, Springfield, Mo.

Engines—Motors—Dynamos

MAKE Electric Motors, half and one horse-power A. C. induction motor winding models show owner how, plain sight. Learn quick, easy. Dept. B, Quinn Bros., Galveston, Texas.

ELECTRIC motors—Reconditioned equal to new. Money back guarantee. A. C. or D. C. ½ H.P. $15.00; 1 H.P. $25.00; 1½ H.P. $30.00; 2 H.P. $40.00. Others 1 to 10 H.P. Tell us your motor problem. Tampa Brothers Motor Co., One Martin Ave., Glendale, Long Island, New York.

Farms and Farm Lands

GET quick cash sale for your property anywhere. Details free. White Realty Agency, Hoth Bldg., Cincinnati, Ohio.

Field Glasses

DAFO Field Glasses, $3 to $14. Alden Loring, Dept. M-2, Oswego, N. Y.

For Electricians and Helpers

THE Electrician's Wiring Manual, by F. E. Needham, 2 E. 4, contains all the information needed for the proper installation of lighting and power systems in houses and other buildings. It completely covers radio electrician wiring and construction in accordance with the National Electric Code. Pocket size, flexible binding, 444 pp. Price $3.50. Popular Science Monthly, 250 Fourth Ave., New York City.

For Inventors

INVENTIONS Sound Can be Sold. Tell you how and help you. Make the sale. Free particulars to prospects. Write W. T. Greene, 856 Dahlia Building, Washington, D. C.

INVENTIONS commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

INVENTORS! Universal Educator contains 100 practical pointers, 30 patterns, tells how, when, how to obtain and sell patents. Suggests new ideas. Explains how to select, price, protect and avoid imposition. Sent free. $1.00 postpaid. Albert R. Hinkle, 681 Outer Drive, Washington, D. C.

INVENTIONS Developed and Patented. Mechanical, electrical, industrial. Experienced engineers and draftsmen. Reasonable rates. Write for booklet. Universal Research Laboratories, Inc., 1123 Broadway, New York.

INVENTORS! Commercial and Industrial Research conducted for Inventors. P. G. Nadham Mfg. Co., Louisville, Ky.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the Quick Action Ad-writing Rate Folder showing How You Can Use Popular Science Monthly Profitably. Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

For Men and Women

EARN $70 Weekly Write home of rural Experience unnecessary. Particulars free. Write George Wagner, 2190 Broadway, N. Y.

FIREMEN, Brakemen, Baggagemen: write or call. Railroad Shopping Co., Train Porters, colored, $150-$250 monthly. Experience unnecessary. 836 Railway Bureau, East St. Louis, Ill.

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Position or work. Experience unnecessary. Write, George Wagner, 2190 Broadway, N. Y.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the Quick Action Advertising Rate Folder showing How You Can Use Popular Science Monthly Profitably. Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

Formulas

MAKE It With Your Own Products. Make them yourself. Formulas, Processes, Trade Secrets. All lines. Catalog, circulars free. C. Thasly Co., Washington, D. C.

MONEY-MAKING Formulas, "Starting a Big Mail Order Business," Secret Selling Methods. All kinds. Many Safe, get my Valuable "Two-Opening" literature before buying. Complete Book Formulas, Miller Manufacturers Chemist, Tampa, Florida.

For the Home

GRANDFATHER Clock Works Built. Build your own clock that strikes hour, make good profit or a present for your friends. Clock works with dial and hands for old or new cases. Write for full particulars. Clock Co., 3 Seventh Street, Peru, Ill.

SAVE your own automatic water heater. Gas or Electric. Write John Kirby, San Luis Obispo, Calif.

Help Wanted

WANTED—Live foreman or mechanic or clerk in every locality in the United States to act as subscription representative for the most popular magazine in the world. Address Manager of Representatives, Popular Science Monthly, 250 Fourth Ave., New York.

Big pay. South American Work. American Home pay fare, expenses. South American Service Bureau, 16000 Alma, Detroit, Mich.

Help Wanted Instruction

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Position or work. Experience unnecessary. Write, George Wagner, 2190 Broadway, N. Y.

FIREMEN, Brakemen, Baggagemen: write or call. Railroad Shopping Co., Train Porters, colored, $150-$250 monthly. Experience unnecessary. 836 Railway Bureau, East St. Louis, Ill.

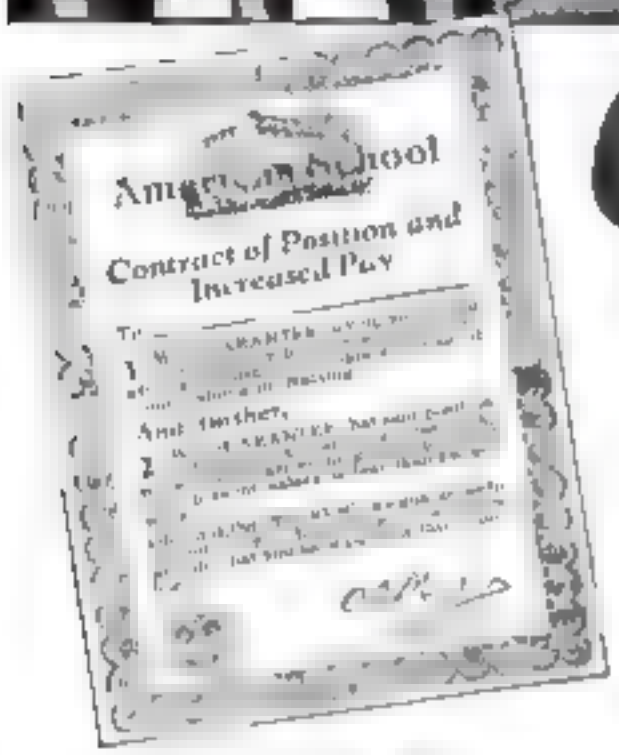
DETECTIVES Earn Big Money. Excellent opportunity. Travel. Position or work. Experience unnecessary. Write, George Wagner, 2190 Broadway, N. Y.

Come into Drafting!

Men who can read blue-prints and draw plans are "sitting pretty" these days. No wonder, when you consider that every machine, every building—all industrial activities *start* on the Drafting table! Intensive production, record-breaking construction operations, have created a great demand for expert Draftsmen capable of designing and calculating original plans.

$50 to $125 a week paid to Expert Draftsmen

Get this point—that Drafting isn't just *one* line of work—it reaches out into the Electrical, Manufacturing, Building Construction, Automotive and Structural industries. That is why you'll find well-paid Drafting positions advertised in all industrial centers of the U. S. 70,000 vacancies reported in the past 12 months. And that is why I advise men to go into Drafting, particularly if handicapped by lack of high-school or college education.



A Drafting Job
paying 50% more than you earn today—without risk!

Now, at a cost you can afford, on terms of only $6 per month, you are sure of getting a fine Drafting position and a substantial increase in pay. A million-dollar institution guarantees both—the training, then the employment service. *Under money-back penalty.*

This agreement brings you your SECOND CHANCE. To repair a neglected education, to specialize, to change to a line where you can get ahead more rapidly. Read it, and investigate it!

The American School

Chartered 31 years as an EDUCATIONAL institution and like the best resident schools and colleges, conducted NOT FOR PROFIT. We offer complete, thorough up-to-date instruction, built by 200 leading Educators, Engineers and Executives. A unique instruction, built to meet the specifications of well-paid jobs as laid down by employers themselves, yet simplified for ready understanding by men with only common schooling.

D. C. M... R...
Director Extension Work

And we are the first in the home study field to recognize the need of giving a COMPLETE SERVICE to ambitious men—training, *plus employment*. Which takes you as you are, supplies the equipment you lack, and lands you in the better job you seek. Without risk to you!

The Entering Wedge to Success in all Building and Manufacturing Lines

I recommend Drafting, too, because it can be QUICKLY learned at home, in spare time—without quitting your job, without losing a day's time or a dollar in pay. Because you're sure there will be a good position waiting when you are ready for it. And because the work is so fascinating and offers better-than-ordinary chances for advancement. For the Draftsman is in close contact with important work and BIG MEN, and he is right in line for promotion to Superintendent and other executive positions.

3 Drafting Lessons! *Actually* FREE!

to prove you can learn at home, in your spare time!

You will never have a more serious personal problem than deciding your future life-work—so we merely urge you to LOOK INTO Drafting. See how you like it, see if you learn as readily as most men do, get the facts about the opportunities, the salaries paid, the jobs open, the chances for promotion. This is why, on receipt of your name, we will send you *the first three lessons of our Drafting course* without cost or obligation.

O. C. MILLER, Director Extension Work,
THE AMERICAN SCHOOL,
Dept. D-97 Drexel Ave. & 58th St.,
Chicago, Illinois

Please send without cost or obligation

1. Three Drafting Lessons.
2. Facts about the opportunities in Drafting.
3. Your agreement to train and place me under money-back penalty.

Name .....

Address .....

Age ..... Occupation .....

The American School

Dept. D-975 Drexel Ave. & 58th St., Chicago, Ill.

Help Wanted Instruction

[illegible]

[illegible]

[illegible]

How to Entertain

[illegible]

Incorporations

[illegible]

Inventions Wanted

[illegible]

Laboratory and Chemical Services

YOUR chemical problem solved and working formula or process furnished for $5.00. Write us. W. Stevenson Richards, Industrial Chemist, Box 2402, Boston, Mass.

Lathes

[illegible]

Miscellaneous

[illegible]

Models and Model Supplies

[illegible]

Moving Picture Business

[illegible]

Music and Musical Instruments

[illegible]

Patents

[illegible]

Patent Attorneys

[illegible]

Patent Attorneys

[illegible]

Patents for Sale

[illegible]

Photography Instructions

[illegible]

Photoplays Wanted

[illegible]

Printing and Engraving

[illegible]

Printing Outfits and Supplies

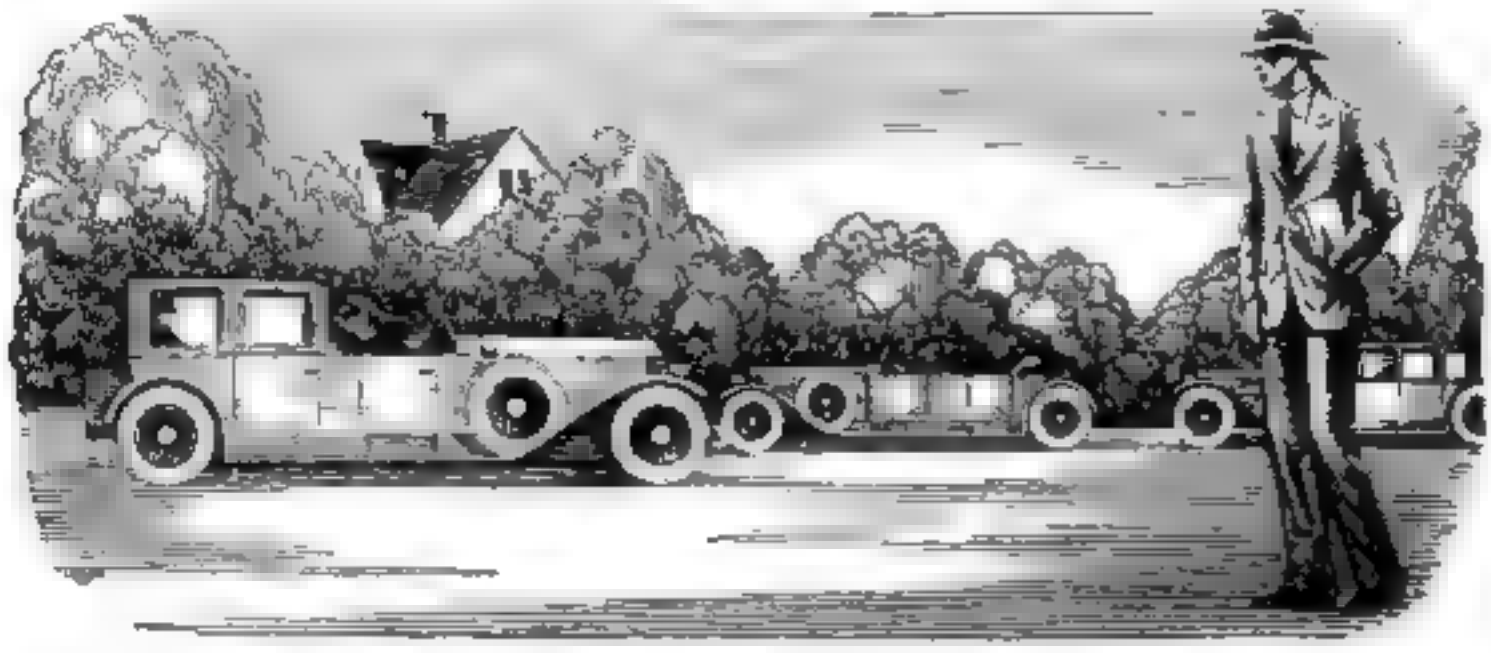
PRINT Your Own Cards, Stationery, Circulars, [illegible]

Radio

[illegible]

Salesmen and Agents Wanted

[illegible]



Many times in the old days, while I trudged home after work to save carfare I used to gaze enviously at the shining cars gliding by me, the prosperous men and women within. Little did I think that inside of a year, I, too, would have my own car a decent bank account, the good things of life that make it worth living.

I Thought Success Was For Others

Believe It Or Not, Just Twelve Months Ago I Was Next Thing To "Down-and-Out"

TODAY I'm sole owner of the fastest growing Radio store in town . And I m on good terms with my banker, too—not like the old days only a year ago, when often I didn't have one dollar to knock against another in my pocket. My wife and I live in the snuggest little home you ever saw, right in one of the best neighborhoods. And to think that a year ago I used to dodge the landlady when she came to collect the rent for the little bedroom I called "home!"

It all seems like a dream now, as I look back over the past twelve short months, and think how discouraged I was then, at the "end of a blind alley." I thought I never had had a good chance in my life, and I thought I never would have one. But it was waking up that I needed, and here's the story of how I got it.

I WAS a clerk working at the usual miserable salary such jobs pay. Somehow I'd never found any way to get into a line where I could make good money.

Other fellows seemed to find opportunities. But—much as I wanted the good things that go with success and a decent income—all the really well-paid vacancies I ever heard of seemed to be out of my line, to call for some kind of knowledge I didn't have.

And I wanted to get married. A fine situation, wasn't it? Mary would have agreed to try it—but it wouldn't have been fair to her.

Mary had told me, "You can't get ahead where you are. Why don't you get into another line of work, somewhere that you can advance?"

"That s fine, Mary," I replied, "but what line! I've always got my eyes open for a better job, but I never seem to hear of a really good job that I can handle. "Mary didn't seem to be satisfied with the answer but I didn't know what else to tell her

It was on the way home that night that I stopped off in the neighborhood drug store, where I overheard a scrap of conversation about myself, a few burning words that were the cause of the turning point in my life!

With a hot flush of shame I turned and left the store, and walked rapidly home. So that was what my neighbors—the people who knew me best—really thought of me!

"Bargain counter shark—look how that suit fits. one fellow had said in a low voice, "Bet he hasn t got a dollar in those pockets." "Oh, it s just Lorkin Anderson," said another "He's got a wish-bone where his back-bone ought to be."

As I thought over the words in deep humiliation, a sudden thought made me catch my breath. Why had Mary been so dissatisfied with my answer that "I hadn t had a chance?" *Did Mary secretly think that too?* And after all, wasn't it *true* that I had a "wish-bone" where my back-bone ought to be? Wasn't that why I never had a "chance" to get ahead? It was true, only too true—and it had taken this cruel blow to my self-esteem to make me see it.

With a new determination I thumbed the pages of a magazine on the table, searching for an advertisement that I d seen many times but passed up without thinking, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the Radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

WHAT'S happened in the twelve months since that day as I ve already told you, seems almost like a dream to me now. For ten of those twelve months, *I've had a Radio business of my own!* At first, of course I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn t long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I ve gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business such as broadcasting, manufacturing, experimenting, ses operating, or any one of the score of lines they prepare you for And to think that until that day I sent for their eye-opening book, I'd been wailing "I never had a chance"

NOW I'm making real money. I drive a good looking car of my own. Mary and I don't own the house in full yet, but I ve made a substantial down payment, and I m not straining myself any to meet the installments.

Here's a real tip. You may not be as bad off as I was But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you d better be doing something about it instead of drifting

This new Radio game is a live-wire field of golden rewards. The work, in any of the 20 different lines of Radio, is fascinating, absorbing, well-paid. The National Radio Institute—oldest and largest Radio home-study school in the world will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip— No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Dept. 44M, Washington, D. C., and the book will be mailed the same day your coupon reaches him. you can have it right in your hands in a few days if you ll mail the coupon **NOW.**

J. E. Smith, President,
National Radio Institute,
Dept. 44M, Washington, D. C.

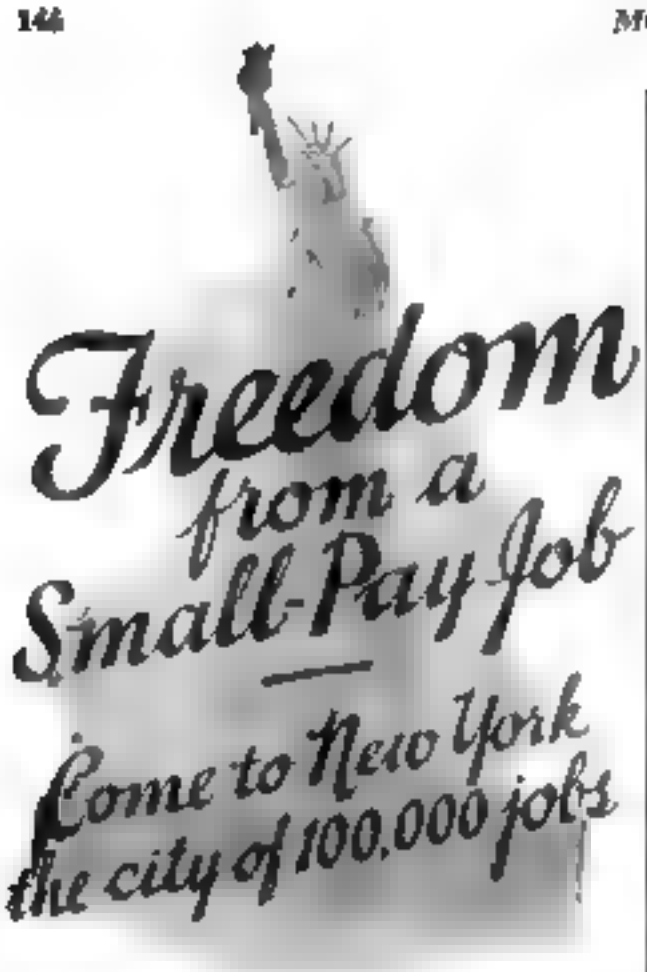
Dear Mr Smith

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

Name

Address

Town State



Freedom from a Small-Pay Job

Come to New York the city of 100,000 jobs

ANY MAN who can read and write and use a pair of pliers can become an electrical expert and free himself forever from the long hours and drudgery of a small pay job.

And you can learn the BIG PAY profession of electricity right in New York City—the heart of the electrical world—the city of 100,000 jobs. At the same time you are learning the BIG PAY profession you can be enjoying the sights and wonders of New York, the modern Bagdad.

Be an Electrical Expert

Graduates of the **NEW YORK ELECTRICAL SCHOOL** are in demand by all the big electrical companies. Or if you prefer the independence of a business of your own, there are thousands of opportunities for efficient, **dependable** men to become electrical contractors. When you are your own boss the money you can make is limited only by your own energy and ability

Personal Instruction

The **NEW YORK ELECTRICAL SCHOOL** is not a correspondence school. You learn by doing—by personal instruction on full size standard electrical equipment under the personal supervision of trained instructors.

AT N Y E S, you train your hands and mind at the same time. You learn the theories of electricity—and then you are shown how to put the theories into actual practice by solving the problems with your own hands.

The man who has learned electricity by actually doing electrical work under intelligent personal instruction can go to any part of the world and be sure of a good living. There are N Y E S Graduates in all the countries of the world.

Write today for the 64-page booklet giving full information about the N Y E S, terms and showing pictures of the equipment available for your personal use in our seven-story buildings.

The NEW YORK ELECTRICAL SCHOOL
40 W. 17th Street, New York

MAIL TODAY

THE NEW YORK ELECTRICAL SCHOOL
40 W. 17th Street, New York

Please send me FREE your 64-page booklet. It is understood that this request puts me under no obligation.

Name

Address

Salesmen and Agents Wanted

ATTENTION !! Collect and keep $6.00 every order. Make from $40 to $90 every week. Big value full and one-half $2.75. Satisfaction guaranteed. Big prizes quick free. LaSalle Gold Shirt Clothes, 537 Broadway, Dept 8a New York.

STRANGE INVENTION! Pays $25 Daily. Keeps telephone and memoranda from tangling and making. Everybody uses secretly. Saves electricity. Sample free. KENNEDY'S, Dept 1 B, 620 Ravenswood, Chicago.

AGENTS WANTED TO SELL ELECTRIC HAIR clippers. Retail at $5.75. Cuts instantly. Useful in every home. The Master Appliance Co. Box 33, Racine Jct. Wis.

WE pay $45.00 a week, furnish auto and expenses to introduce our soap and Washing Powder. Home-Health Company Dept. A18, Chippewa Falls, Wis.

ALL Advertisers should not be without the important facts on Money Making. Write today for the "Quick Action Advertising Rate Folder" which contains information of value to you. If you are anxious for quick profit returns, do it now! Address your inquiry to Manager Classified Advertising, Popular Science Monthly, 242 Fourth Ave. New York.

Song Writers

SONG Writers. Let's see what you have to offer! Eschar Sloan Publisher, 1547 Broadway, New York City.

SONG WRITERS! Get in touch with me at once. Bell, 1542 47 S. do Broadway, St. Louis, Mo.

SONG poems wanted; write us. Have real proposition. Hubbeler Dpt. 2484 W. Keystone, Chicago.

Stamps and Coins

STAMPS 100 All Different 2 cents. Lists free. $ 1 quarter 5 stamps. Toledo, Ohio.

20 VARIETIES unused from Postage St. P. E. Mixed 5 stamps. Toledo O.

[illegible] not Approvals to the United States. Stamps 1st Ninth Ohio.

20 RARES 10c different 5c to approval applicants. Rares, Dept, Decatur, Indiana.

STAMPS, 100 China, etc. for 25 cents (500 Illustrations $1. Bullard, Station BH, Boston.

RARE coins, United States and foreign dates, war medals and decorations. Stamps 10c and catalogue. 10c. Alvin Newcastle Colorado Springs, Colorado.

U S. FUNSTA gold quarter size. 27c, $1/2 size, 15c. White cent and Catalogue, 10c. Norman Shultz, Salt Lake, Utah.

COIN Collectors Fall sales catalog of coins for sale free to collectors only. Catalog quoting prices paid for coins, ten cents. William Hesselden, 1010 Tremont St., Boston, Mass.

ALL Advertisers should not be without the important facts on Money Making. Write today for the "Quick Action Advertising Rate Folder" which contains information of value to you. If you are anxious for quick profit returns, do it now! Address your inquiry to Manager Classified Advertising, Popular Science Monthly, 240 Fourth Ave. New York.

COINS Stamps and Coins are valuable. Stamp & Coin Collector Magazine tells about them. Sample free. Krause, 409 Juneau, Milwaukee, Wis.

STAMPS free. Stamp collection from eleven foreign countries free for sending 4c postage for no price list. Album 10c. 21 German Stamps 25c. Argonaut Stamp Co. Dept. 1 B, New Orleans, Utah.

NEWFOUNDLAND postage stamps wanted. Will give bargain prices. Ben Butler, St. Georges, Newfoundland.

FREE Complete Mexican $1 bill with purchase of 100 different foreign stamps for a dime. E. NAGLE, 1185 Marion, Reading, Pa.

Stories Wanted

BIG demand for Photoplay and Magazine Stories. We revise, develop and sell right. Full or compensation. Established 1917. Booklet free. Universal Research Company, 414 Western & Santa Monica Building, Hollywood, California.

Telegraphy

TELEGRAPHY. Both Morse and Wireless taught thoroughly and quickly. Terms reasonable and salaries. Wonderful opportunities. Prepare now for chance to earn part. School established fifty years. Catalog free. Dodge's Institute, 1374 Hart Ave., Valparaiso, Ind.

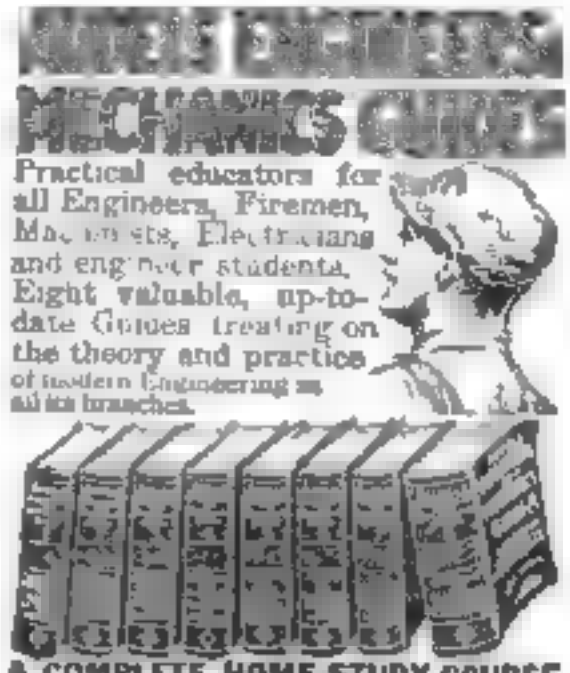
Typewriters and Supplies

TYPEWRITERS—Factory Rebuilt Royals, Remingtons, Underwoods, New Royal, Remington and Corona Portables. New Typeliograph Rotary Stencil Duplicator $17.50. Terms. Catalogue Free. Pittsburgh Typewriter Supply, 343—339 Fifth Ave. Pittsburgh, Pa.

Wanted

WANTED: Live foreman or mechanic or clerk in every factory in the United States to get a subscription representative to the most popular magazine in the world. Address Manager of Representatives, Popular Science Monthly, 240 Fourth Ave., New York.

COURSES wanted. Used correspondence school courses. Liberal prices. Ansalys' 2353 Main, Buffalo.



Practical educators for all Engineers, Firemen, Machinists, Electricians and engineer students. Eight valuable, up-to-date Guides treating on the theory and practice of modern Engineering in all its branches.

A COMPLETE HOME STUDY COURSE AND REFERENCE LIBRARY

$1 a mo.

4 pocket numbers with Ready Reference Index, 3754 pages, 4"x6" illustrations. Easy to read. Highly endorsed. A good help in securing Engineer's License. Price $12; terms $1 per month. Free Trial.

INFORMATION — In A Handy Form. Answers to Your Questions and Problems. Here is a partial list of the subjects covered:— **Engine Principles, Valve Setting, Pumps, Corliss Engines, Uniflow Engines, Pumping Engines, Contractors Engines, Locomotives, Marine Engines, Turbine Engines, Gas Engines, Oil Engines, Indicators, Producers, Aviation, Steam, Fuel Economy, Boiler Construction, Firing, Oil Burners, Stokers, Boiler Repairs, Pipe Fitting, Heating, Refrigeration, Elevators, Dynamos, Motors, Lighting, Wiring, Electrical Diagrams, Radio, Electrical Reference and Calculations.**

SHIPPED FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Fill in coupon in pencil. Send now—today—get this standard library for Engineers and Mechanics.

FREE EXAMINATION COUPON

Theo. Audel & Co., 65 W. 23 St., N.Y. City
Send me AUDELS ENGINEERS AND MECHANICS GUIDES, 4 numbers, $12 for *free examination*. If satisfactory, I will send you $1 in 7 days, then $1 monthly until $12 is paid.

Name .....
Address .....
Occupation .....
Employed by HFT-54

LEARN IN LOS ANGELES

TRAINED MEN NEEDED. Earn $40 and up a week. If you are earning less this is your chance to gain. Auto Industry will pay you more and offer greater opportunity. You qualify for Big Pay Job through National's Famous Job Experience Training. Over 17,000 Successful Graduates. California is Land of Opportunity. Money being spent on autos here. Learn Mechanics, Ignition, Repairs, Construction, Garage Management, Etc. Qualify for technical or executive position or go into business for yourself. ENTER NOW. No Age Limit. Low Tuition. 33rd Year. Unexcelled Training. Thirty-two instructors. Free employment service while learning and after graduation. Write for Illustrated Catalog. FREE. Tells everything.

NATIONAL AUTOMOTIVE SCHOOL

DEPT 33A 4006 Figueroa St. Los Angeles, Calif.
Send me the Big FREE National Auto Book that explains how I can Succeed in the Automobile industry.
Name .....
Address .....
City ..... State ..... Age ...

Learn Commercial Art

Federal Students Are Making BIG MONEY

Hundreds of Federal Students, from all walks of life, have become successful commercial artists, and are making more money than they ever made before. Just read what they said

Lloyd Shirley Says:

"I feel as though my old days of drudgery were a bad dream. Now I am earning $5200 a year as an artist. The practical, thorough, short course I took with the Federal Schools made my success possible."

"Owes Success to Federal"

"The Federal Schools showed me the direct way of turning my liking for drawing into money giving, in a short time, knowledge which otherwise takes many years of hard experience to acquire. I owe much of my present success to the Federal Schools." (Name on Request)

"$400 Last Month"

"I am Art Director with a salary and commission which has made it possible for me to earn more than at any time in my life for example last month ran over $400, and for the last four months it has averaged $300. I know this all came about from the instructions I received from the Federal Schools." Mr. W. A. Sowell.

Two-Year Contract, $80 a Week

"You might like to know I am leaving this place to take up a new job as Art Director, for which I have a 2-year contract at $80 per week I owe a debt of gratitude to the Federal Schools for starting me right." J. R. McKinney

Don't Daydream . . . . . Act!

IF YOU like to draw, but cannot afford to give up your present position to attend art school, this advertisement shows you an easy, pleasant way to develop your talent at home in spare time and become a successful commercial artist, earning big money, as hundreds of others have already done.

How often have you wanted to get away from the grind and drudgery of your daily routine—to develop your natural ability to draw—to be able to achieve success and a comfortable income as a commercial artist? Here is the big opportunity you have been waiting for—

Learn Commercial Art at Home

The Federal School has made available a complete course in commercial designing, that will soon prepare you to earn a handsome income. It has been arranged with the co-operation of many nationally-known artists, to train students in the **quickest possible time.** No previous training is necessary. If you are really interested in art, and ambitious, you can be successful.

Trained Artists Highly Paid

Many Federal students are making $2000, $3000, $4000 $5000 and $6000 a year—some even more. Frequently students earn more than enough to pay for their Federal Course even before they have finished. The field of commercial art is practically unlimited. Hundreds of advertisers are buying thousands and thousands of dollars worth of illustrations every month *And they have paid as much as $1000 for a single picture!*

Federal School of Commercial Designing

1351 Federal Schools Bldg., MINNEAPOLIS, MINN.

Please send me book "YOUR FUTURE" and Art Ability Questionnaire, without cost or obligation.

Name

Age

Present Occupation

Street and Number

City State

SEND FOR THIS FREE BOOK

Send coupon for our book, "YOUR FUTURE," describing this fascinating home-study course. We will also send you free art ability questionnaire which tests your natural sense of design, proportion, color, etc. No obligation—Just mail the coupon TODAY

THE SCHOOL FAMOUS FOR SUCCESSFUL STUDENTS

The Letter That Saved Bob Johnson's Job

—and paved the way for a better one!

"It was written to his employer by the International Correspondence Schools. It told how 'Robert Johnson had enrolled for a course of home-study and had received a mark of 94 for his first lesson.'"

Bob answered the summons to the chief's office with just a little fear and trembling, for a lot of men were being dropped—a lot more were having their pay reduced.

But as Bob came in, his employer did a surprising thing. He got up quickly from his desk and grasped Bob warmly by the hand.

"I want to congratulate you, young man, on the marks you are making with the I. C. S. I am glad to see that you are training yourself not only for your present job but for the job ahead.

"We're cutting the pay roll. Until I received this letter, I had you in mind as one of the men to be dropped. But not now. Keep on studying—keep your eyes open—and pretty soon there'll be a still better job for you around here. We're always looking for trained men."

Won't you let the I. C. S. help you, too? Won't you trade a few hours of your spare time for a good job, a good salary and the comforts that go with it? Then mark the work you like best on the coupon below and mail it to Scranton today. That doesn't obligate you in the least, but it will be your first big step towards success. *Do it now!*

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 7087 F Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet "Who Wins and Why" and full particulars about the subject before which I have marked X.

BUSINESS TRAINING COURSES

- ☐ Business Management
- ☐ Industrial Management
- ☐ Office Management
- ☐ Traffic Management
- ☐ Accountancy and C. P. A. Coaching
- ☐ Cost Accounting
- ☐ Bookkeeping
- ☐ Salesmanship
- ☐ Secretarial Work
- ☐ Spanish ☐ French
- ☐ Advertising
- ☐ Better Letters
- ☐ Business Correspondence
- ☐ Show Card and Sign Lettering
- ☐ Stenography and Typing
- ☐ Civil Service
- ☐ Railway Mail Clerk
- ☐ Common School Subjects
- ☐ High School Subjects
- ☐ Illustrating ☐ Cartooning

TECHNICAL AND INDUSTRIAL COURSES

- ☐ Electrical Engineering
- ☐ Electric Lighting
- ☐ Mechanical Engineer
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Railroad Positions
- ☐ Gas Engine Operating
- ☐ Civil Engineer ☐ Surveying and Mapping
- ☐ Plumbing and Heating
- ☐ Steam Engineering ☐ Radio
- ☐ Architect
- ☐ Architects' Blueprints
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ Chemistry ☐ Pharmacy
- ☐ Automobile Work
- ☐ Airplane Engines
- ☐ Agriculture and Poultry
- ☐ Mathematics

Name .....

Street Address .....

City ..... State .....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal

Here Are Correct Answers To Questions on Page 66

1. When Greenland was discovered by Norsemen, it was summer. In the summer the southwestern coast which they first saw is free of ice and covered with Arctic vegetation. The ice-covered plateau of central Greenland is not visible and the entire island seems fertile and hospitable.

2. In eastern New York, along the valley of the Hudson River between Albany and New York City, workmen frequently dig from swamp lands the tusks and other bones of great elephants that once roamed up and down this valley.

3. The kingdom of Wahabis, in the eastern part of Arabia. The Wahabis constitute one of the numerous sects of Mohammedans, one of whose principles is prohibition of all forms of alcohol and tobacco.

4. This is done to supply water to the mining camp of Kalgoorlie in the southern part of western Australia, south of Lake Barlee. All of the natural lakes in the region are salty. The country is desert. When valuable minerals, especially gold, were discovered in that region, a 300-mile pipe line was built to bring water from near the coast.

5. Since the stalks of bamboo are very strong as well as light, many of the first railway bridges in Japan were built by lashing bamboo poles together. Nowadays, with the development of the manufacture of steel in Japan, most of these picturesque bamboo bridges have been replaced by modern steel structures.

6. The drink called sarsaparilla is named after a drug plant that grows in the swampy forest lands of Honduras in Central America. The plant was introduced into Europe by the Spanish conquerors nearly 300 years ago. It constitutes one of the important exports from Honduras.

7. Its capital was at the modern town of Cuzco in what is now southern Peru. From here south to Lake Titicaca the traveler still may see the ruins of many ancient buildings, roads, and other works, testifying to the greatness of the ancient Inca state.

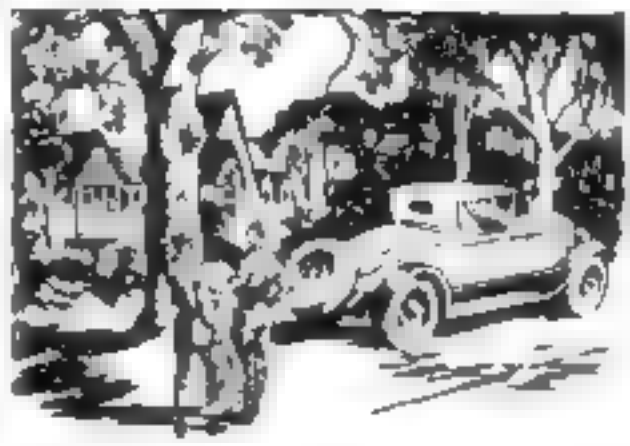
8. This name has been given to the island of St. Thomas in the former Danish West Indies. While St. Thomas is of value as a point of defense of the Panama Canal, it scarcely can be said to command the approaches to this canal as efficiently as the great British fortress of Gibraltar commands the mouth of the Mediterranean Sea.

9. This name is given by geographers to the vast grass-covered plains of southern Russia, plains not unlike the prairies that once covered the central part of the United States.

10. In the towns of southern Arizona, notably in the city of Tucson, there is so much hot sunlight that many residents procure household hot water by placing iron tanks on the roofs of the houses.

11. The greatest ruins now known are probably those of Pueblo Bonita, or "Beautiful Village," in northwestern New Mexico. When the vanished race of the cliff-dwellers lived in southwestern North America, this village was an important city.

12. Leadville, in central Colorado, southwest of Denver. The town nestles in a mountain valley more than 10,000 feet above the sea. The air at Leadville is so thin that persons unaccustomed to high altitudes find serious difficulty in breathing.



Young men needed *by*

Davey Tree Expert Co.

Interesting, vigorous outdoor work in a growing organization where merit wins advancement. Good starting wages. Permanent position and a real future for men who make good. Our present field force of Davey Tree Experts cannot meet the increasing demand. So we are selecting now to enter our employ, a few sturdy, clean young men, thorough Americans, single, between 20 and 30 years old, free to travel, industrious, with good practical education, and able to give good references. Write for qualification blank to serve in place of personal interview. The Davey Tree Expert Co. Inc., 130 Federal Bldg., Kent, Ohio.

Statement of Ownership, Management, Circulation, etc., required by the Act of ... of August 24, 1912, of Popular Science Monthly, published monthly at New York, N. Y., for Oct. 1, 1915. State of New York, County of New York, ss. Before me, a notary public in and for the State and county aforesaid, personally appeared ... who, having been duly sworn according to law, deposes and says that he is the Business Manager of Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication, for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Science Publishing Co., Inc., 250 Fourth Avenue, New York, N. Y. Editor, Raymond N. Ditmars, 250 Fourth Avenue, New York, N. Y. Managing Editor, Raymond L. Ditmars, 250 Fourth Avenue, New York, N. Y. Business Manager, Percy T. Hopkins, 250 Fourth Avenue, New York, N. Y. That the owners are: Popular Science Publishing Company, Inc., 250 Fourth Avenue, New York, N. Y. The stockholders of Popular Science Publishing Company, Inc., are: J. Mabel Jones, William H. ..., New York, N. Y. ..., 250 Fourth Avenue, New York, N. Y. Robert ... Wilson, ..., Springfield, N. J. ... Wilson, ..., Springfield, N. J. ... Thirtieth St., New York, N. Y. ..., Chicago, Ill. ..., 250 Fourth Avenue, New York, N. Y. ..., 250 Fourth Ave., New York, N. Y. John Nichols, 250 Fourth Ave., New York, N. Y. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of the total amount of bonds, mortgages, or other securities are: none. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

... Raymond L. Ditmars, Business Manager.

Sworn to and subscribed before me this ... day of September, 1915.

... Notary Public, Kings County. (Clerk's No. ..., Register No. 190 ... New York County Clerk's No. ..., Reg. No. 8,102.)

... commission expires March 30, 1916.

Agents—Salesmen

Sample, 20c

A whirlwind seller for agents ... nets $3.60 daily on $36.00 gross. Write today for complete details.

All-In-One Sales Co.
Dept. 4-L 1648 Grand Ave.
MINNEAPOLIS, MINN.

MOVIES Teach You ELECTRICITY *for a Bigger Paying Job*

HERE is a *new, amazingly simple and practical way* of learning to do electrical work—so sure of results that we agree to give you the training and employment service that will get you a better job and more money or you need not pay a cent!

Think of it! You take no chance. You are assured of thorough preparation for the many opportunities in this great industry which is constantly calling for more trained men. We not only train you, we help you get the job. How can we do it? ***By a wonderful new method of teaching which makes everything about electricity easy to understand.***

Learn at Home, Easily, Quickly, Thoroughly

We furnish you with the projector, so simple anyone can operate it, and thousands of feet of film. You see all types of electrical machinery in operation, animated diagrams which make the facts about electricity as plain, easy to grasp and as enjoyable as looking at a movie in your favorite theatre.

You are personally guided in this live, fascinating instruction by practical engineer-educators, including Bruce Rogers, M. S. Western Electric Co., J. A. Shimek, M. E., DeVry Corporation; A. P. Hollis, former Director Visual Education, University of North Dakota; W. N. Littlewood, formerly instructor in University of Wisconsin, and others.

What a Practicing Engineer Says:

Here's what a practical electrical engineer says: "I am amazed at how simply you explain the facts about electricity. The points are so much easier to grasp than by the usual methods of instruction that the student must make quicker, surer progress. I only wish I had had the advantage of your instruction methods. It would have made things so much easier!" Charles E. Fitz, M. E., E. E., formerly associated with Steinmetz.

Employers Want Film-Way Trained Men

Our employment service helps you locate a big pay job in the branch of electricity which interests you most. Aviation Electricity, Radio, Switchboard Work, Sub-Station and Power Plant Operation, Automotive Electricity, Wiring, Contracting, Merchandising, etc. Here is an extract from a letter written by an employer:

"We will gladly co-operate with you, not only in employing any of your students when vacancies occur in our organizations, but also by recommending that our employees take your course."

ELECTRIC MATERIAL CO., South Bend, Ind.

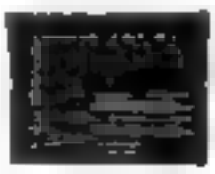
FREE Three Lessons and Our New Book, "The Film Way to Bigger Pay in Electricity"

If you act now, by mailing the coupon, we will send you absolutely free and without obligation, three actual lessons showing how we use real motion pictures to make the facts about electricity easy to grasp. Our new book describes the wonderful opportunities for a better job in electricity and gives complete details of this fascinating way to learn.

Start now to move into the bigger pay class. Sending coupon is the first step. Do it now, learn how you can get the things you want in life.

You Use This Real DeVry Projector

Anyone can operate this standard school model DeVry projector (value $75) which is furnished every student for use during course *at no extra cost.* Uses ordinary light connection, farm lighting equipment or auto battery. Gives clear, brilliant, flickerless motion pictures in your home.



Drafting Set Given

Course includes instruction in drafting and complete set of professional instruments as shown, with drawing board, T square, scales, rules, paper, etc., all given at no extra cost. You get everything necessary for this complete course in electricity with drafting.

The NATIONAL SCHOOL of VISUAL EDUCATION

"The Film Way to Bigger Pay"

337 South Dearborn St., Dept. 12F CHICAGO, ILL., U. S. A.

Without obligation to me please send me free lessons and your book, "THE FILM WAY TO BIGGER PAY IN ELECTRICITY."

Name .....

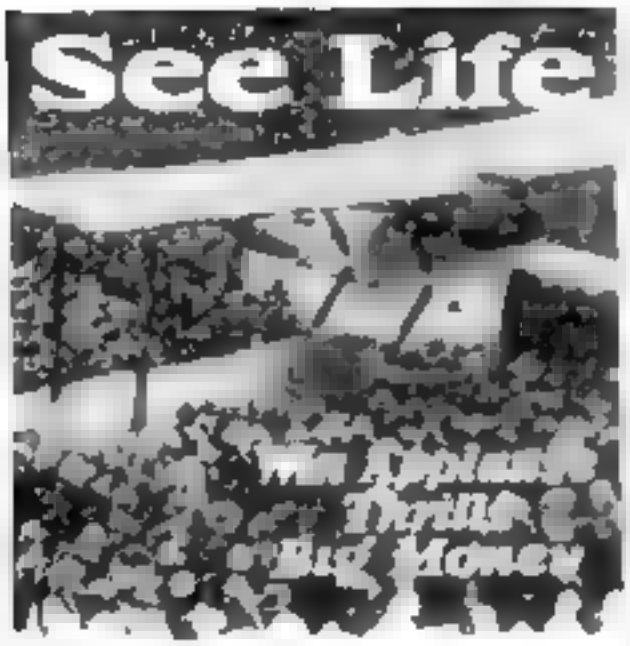
R. F. D. ..... Age .....

City .....

State .....

Occupation .....

TAKE THE FILM WAY TO *Bigger Pay*



Get Into Aviation!

ARE you a red-blooded, daring he-man? Do you crave adventure, popularity, admiration, and the applause of great crowds? Then why not get into the Aviation Industry—the greatest adventure since time began—the greatest thrill ever offered to man?

Think what Aviation offers you. The praise and plaudits of the multitude. And a chance to get in on the ground floor where rewards may be unlimited. Aviation is growing so swiftly that one can hardly keep track of all the astonishing new developments. Air-mail routes have just been extended to form a vast aerial network over the entire U. S. Many Commercial Airlines and airplane factories are now being organized. Men like Henry Ford are investing millions in the future of commercial Aviation for they see its great possibilities.

Easy to Get Into Aviation By This Home Study Method

Get into this thrilling profession at once while the field is new and unoverrun. Now, by a simple new plan you can quickly secure the home study and practical training at home in spare time hours which will teach you the secrets and fundamentals of Practical Aviation, give you all the inside facts that are essential to your success. And the study of Aviation by this remarkable method is almost as fascinating as the actual work itself.

PICK YOUR JOB!

Flying
Airplane Instructor
Airplane Engineer
Airplane Designer
Airplane Assembler
Airplane Mechanician
Airplane Inspector
Airplane Builder
Airplane Salesman
Field or Hangar Manager
Airplane Contractor
Airplane Motor Expert
Airplane Designer

Send for FREE Book!

Send coupon for our new free book, just published, containing a discussion on the *Airplane for Pleasure*. It is vitally interesting reading like a romance and tells in picture and text this astonishing profession you can prepare for at home. Send for your copy today. Write for your copy today.

AMERICAN SCHOOL OF AVIATION
3601 Michigan Ave., Dept. 1288 Chicago

AMERICAN SCHOOL OF AVIATION
3601 Michigan Ave., Dept. 1288, Chicago, Ill.

Without obligation please send me your FREE book describing the opportunities in Aviation and explaining how I can prepare for one of these positions in Practical Aviation.

Name ..... Age .....

Address .....

City ..... State .....

Windmill Plane Makes Good

(Continued from page 15)

more pilots than any other fault in aviation, and those who have flown the autogiro say it will not stall. From the point of view of the private plane owner, whose numbers have grown greatly in the last two or three years, the autogiro promises much. No country has enough airdromes or landing fields to accommodate pilots in large numbers. On the largest field only a few planes may land or take simultaneously owing to the run needed for the start and finish of a flight. Almost any lawn will suffice for the autogiro, says the young inventor, as soon as he has perfected a self-starting device. This he plans as his next step in the development of the machine. But even without the self-starter, the autogiro will take off from a field too small to accommodate any other type of plane. In landing on ship decks the autogiro is expected to be particularly useful, for it will not be necessary for the ship to be traveling head against the wind, as is now the case. Therefore aircraft carriers, the inventor predicts, will become more useful to fleets, for they will be able to proceed with the remainder of the vessels regardless of direction.

FOR night and fog landings the designer declares the present dangers will have been overcome, as it will always be possible to stop the autogiro engine and descend vertically and slowly.

The machine flown across the Channel and then on to Paris by De la Cierva has an Avro body equipped with an Armstrong Siddeley Lynx IV engine of 180 horsepower. Its maximum speed is 105 miles an hour, and its cruising speed, eighty-five. Minimum speed under power is twenty-five miles an hour, and its minimum gliding speed twenty-five miles an hour. It is said to be able to climb 500 feet a minute.

Arriving at Paris from St. Inglevert after crossing the Channel, De la Cierva gave a demonstration before M. Paulève, Minister of War; General Pujo, director of aeronautics, Commandant Renoirt of the Le Bourget airport and several thousand spectators. In his vertical descent before competent observers the autogiro stopped the first time within ten feet of the spot where it first touched on the ground, and within seven feet on a second descent.

Immediately after the demonstration, De la Cierva was invited to a long interview with the French war minister and afterwards was feted by the Aero Club de France.

"This," said the French press, "was a convincing demonstration.

THE French, having seen the convincing demonstrations in aeronautical progress of Santos Dumont, of Blériot, of D'Oisy, of Costes, Landbergh, Byrd, and others whose names compose a brilliant legion, should know one when they see it.

On his second day's trials at Le Bourget field, De la Cierva attempted a vertical descent from a height of 600 feet. He had already descended to within a few feet of the roof of the customs building, retarding his speed and hanging evenly above the heads of the spectators standing on the terraced roof. He climbed again, drew back his stick, and the plane whirled down.

The machine landed heavily breaking the landing gear and damaging the rotor. The upper propeller had failed to check the speed sufficiently but De la Cierva and his passenger Frans Reichel of the Aero Club de France escaped unhurt.

The crashes of the autogiro have always been like this since the days of the earliest demonstrations. Accidents have occurred, but none of them has been fatal, and they have not been accidents due to any inherent weakness of the design.

SPARE TIME TRAINING *that leads to* BIGGER PAY

Do you want a better position and a higher salary? You can have these! You can do it spare time. A book we will show you how others are doing it and how you can do it, too, is free. It tells how LaSalle Problem Method trains you in your spare hours, at small cost, for the position you want in the business field you like best. Check the coupon below and mail it today. Get the facts about the opportunities in your chosen field. Find out how the salary increasing plan starts you on the road to success and financial independence. Check and mail the coupon NOW.

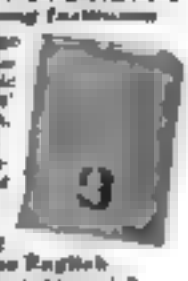
— — — Find Yourself Through LaSalle — — —

LA SALLE EXTENSION UNIVERSITY
The World's Largest Business Training Institution

Dept. 1243-R Chicago

Tell me about your salary-increasing plan for my advancement in the business field checked. Send also copy of "Ten Years' Promotion in One," all without obligation.

- ☐ Business Management
- ☐ Modern Salesmanship
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Railway Station Management
- ☐ Law: Degree of LL.B.
- ☐ Commercial Law
- ☐ Industrial Management
- ☐ Banking and Finance
- ☐ Modern Business Correspondence
- ☐ Modern Foremanship
- ☐ Personnel Management
- ☐ Expert Bookkeeping
- ☐ Business English
- ☐ Commercial Spanish
- ☐ Effective Speaking
- ☐ C. P. A. Coaching
- ☐ Stenotypy
- ☐ Telegraphy
- ☐ Credit and Collection Correspondence



Name .....

Present Position .....

Address .....

Why Good Dancers Are Popular

Everyone admires and wants to dance well. The girl who refuses to dance is left out. There is no need of being a wallflower. In any reputable home you can learn the latest dances in a few hours. Arthur Murray's easy method teaches you the secrets of leading and following. You learn in your own home, at your own convenience, without music or partner. Many people learn to dance in a few hours by this remarkable method. Mail the coupon for free booklet and full particulars of this offer. Don't delay. Do it now.

ARTHUR MURRAY Studio 842, 7 East 43rd St., New York

ANY BOOK IN PRINT

Delivered at your door. We pay the postage. Standard and new, fiction and technical books all at biggest savings. Be sure to get our catalog. Just send us a postcard for Clarkson's catalog.

FREE Write for our great book catalog. This catalog is a short course in literature and is used by some of America's leading universities. We can send books anywhere in the world. Free. Postpaid. Write today.

CLARKSON PUBLISHING CO.,
1200 CLARKSON BLDG., CHICAGO, ILL.

Learn Photography at HOME

Make money taking pictures. Prepare quickly during spare time. A common school education sufficient. No experience necessary. New easy method. Nothing else like it. Send at once for free book. Opportunities in Modern Photography and full particulars.

AMERICAN SCHOOL OF PHOTOGRAPHY
Dept. 1288 3601 Michigan Ave. Chicago, U. S. A.

POPULAR CHEMISTRY
A Monthly Chemical Magazine

Latest interesting experiments, formulas, news in chemistry. Invisible ink, perfumes, soaps, dyes, household chemistry. Many valuable formulas. Send 10 cents for sample copy. Price $1.00 a year. Send for free catalog of chemical books.

POPULAR CHEMISTRY COMPANY
Dept. 30, Moorestown, N. J.

Wonders from Sulphur

Continued from page 86

nated with sulphur have been carrying on an endurance race with ordinary ties and posts. After three years, they are reported to be in good condition, while the untreated wood has been showing increasing signs of deterioration. Not only do such ties wear longer, but they can be made of cheaper wood. This treatment, in which soft woods are said to become the equal of hardwoods, may play a big part in the solution of the problem of timber shortage.

Tool handles, made of cheap wood, may be given their quota of sulphur and be made hard and strong. The same treatment may be used to improve the wood used in the spokes of wheels, in agricultural implements, and in silo staves. On Long Island, N. Y., a line of telegraph poles was treated with sulphur at the danger line of decay, the ground line, and the results are being closely watched.

BECAUSE sulphur is resistant to acid, it is being used to treat the wood that goes into the "pickling" vats in which steel and iron are cleansed with a solution of dilute sulphuric acid. In laboratories and factories where acid is likely to affect the wood floors, sulphur-treated blocks are expected to solve the problem.

Recently pineapple growers in Hawaii wrote to Kobbe for help. The wooden boxes in which the fruit was collected rotted quickly when left in the fields during harvest. Could he suggest anything to make them more resistant to the weather? He could. The solution lay in sulphur treating.

Another letter came from a salt mine in Poland. The timbers of the mine began to rot almost immediately after they were put in place. What could be done? Again the remedy was to impregnate the wood with sulphur.

From the oil fields of the Southwest, another interesting request came to Kobbe recently. An oil well "shooter" wanted a stiff cartridge made to contain the nitroglycerin which he lowered into the well-hole, and he wanted it made of paper!

Sulphur-treated paper promises as much as any other phase of the work Kobbe is doing. Ordinary paper, after a treatment, becomes stiff and strong as wood, resistant to the weather, to water, and to most acids. It is expected to find practical use in a wide variety of everyday necessities, including items such as chair seats, outdoor billboards, automobile door panels and running boards, table tops (especially where acids are being handled), waterproof paper cans, and possibly piping.

RECENTLY a paper tube with walls only three-sixteenths of an inch thick was impregnated with sulphur. Before the treatment, you could break it over your knee. Afterwards it supported the weight of a man!

Paper maché, similarly treated, also offers a wide range of possibilities. Storage battery boxes, toilet seats, and flowerpots are among the products made in this way. It is even suggested that weatherproof beehives of paper maché will be the next step!

One of the products of sulphur-treated paper which has interesting possibilities is a cap designed to fit over the tops of telegraph poles to keep water from entering the wood and hastening decay.

Just how impervious to water would such a cap be? The answer is found in a four-year-old snowball. In 1924, Kobbe dropped a snowball into molten brimstone. It came out with a sulphur shell around it. The snow melted within, but when the ball was put on the scales the other day it weighed exactly the same as it did in the beginning. In four years, not a fraction of an ounce of the water which you could hear swishing about within had escaped through the thin sulphur shell!

Get a BIG PAY JOB in ELECTRICITY

LEARN TO EARN $70 to $200 A WEEK

If you are making less than $70 a week INVESTIGATE

Electricity—The Big Pay Field

I'll Train You At Home

You Earn As You Learn

Money Back If Not Satisfied

If Not Earning $70 A Week—Investigate

L. L. COOKE,
Chief Instruction Engineer

L. L. COOKE SCHOOL OF ELECTRICITY
Dept. 30
2150 Lawrence Ave.
Chicago, Illinois

6 BIG OUTFITS TO WORK WITH NO EXTRA COST

FREE BOOK COUPON

L. L. COOKE, Chief Instruction Engineer

Name
Address
City State

The "Cooke" Trained Man is the "Big Pay" Man

A definite program for getting ahead financially will be found on page four of this issue

Travel on "UNCLE SAM'S" Payroll

RAILWAY POSTAL CLERKS

$158 to $225 Month

MAIL COUPON

FRANKLIN INSTITUTE, Dept. J276
ROCHESTER, N. Y.

Sirs: Rush to me without charge (1) 32-page book describing positions as Railway Postal Clerk and City Mail Carrier; (2) tell me how to get a U. S. Government job; (3) send me list of positions now obtainable, with sample coaching.

Name
Address

Steady Work—No Layoffs—Paid Vacations
See Your Country
Many other Government Jobs obtainable.
MEN—BOYS; 18 UP

Would you give the price of a shave to earn

THOUSANDS IN RADIO?

Mail coupon below for details of amazing home-study radio course.

THE Radio Institute of America, conducted by RCA and sponsored by General Electric and Westinghouse, now offers you at remarkably low cost the training you need for success in radio. The price of an occasional shave saved, more than pays for it!

Nothing so clear, comprehensive and up-to-date, nothing so generous in apparatus furnished has ever before been offered in radio training by any organization.

Helped thousands to succeed

This is basically the same course that has enabled our thousands of graduates to advance to positions of importance and high remuneration in the respected profession of radio. But new and revolutionary changes make the instruction clearer and easier, permitting faster progress—and the course now embraces television, airplane radio equipment and photo-radiograms.

You can study at home—when you please and as long as you please. Your rate of progress is limited only by your own ability.

Mail coupon now

It brings you—free—an interesting illustrated booklet that shows the tremendous opportunities in the radio industry and tells how the Radio Institute of America's course of home study can show you the way to big success in Radio. Mail the coupon at once.

RADIO INSTITUTE OF AMERICA
Dept. J-12 326 Broadway
New York, N Y

RADIO INSTITUTE OF AMERICA

Dept. J-12 326 Broadway
New York City

Please send me your new booklet with full information about your Home Study Course of Radio Instruction.

Name .....

Address .....

City .....

So They Wrote to Edison—

(Continued from page 17)

Japanese gentleman sent a letter of six pages testifying of the great happiness that the incandescent light has brought into his life, and saying that he felt like bowing every time he passed an electric light. The evident sincerity of some of these letters has given great pleasure to the inventor.

All in a class by themselves are the real and near inventors who want Edison to market or complete their inventions for them. It is a poor mail that does not bring some of them. Some days there are as many as seven or eight. If a name were desired to designate this class we might borrow from the florist's catalogue and call them "hardy perennials." Year in and year out they come in an endless stream. If Edison could multiply himself by one hundred he might be able to take care of them, but as it is he is so overwhelmed by his own multitudinous affairs that he uniformly excuses himself from giving them consideration, unless the invention relates to his own line of products, in which case it is simply sent to the legal department for investigation and report. But this does not happen once in a hundred cases.

WHILE many apparently meritorious inventions are submitted, the greatest number covers all sorts of freak ideas, from an improved mouse trap to perpetual motion machines. Some notion of the variety of these suggestions may be gathered from the one day's mail which included ideas for a noiseless typewriter, a cement gas range, a nursery cabinet, and a blind man's watch containing a miniature photograph to call out the time. All that the inventors usually ask is that Edison shall complete the invention, put it on the market with his name behind it, and divide profits with them, and there you are! The easiest kind of a trick for a man who has nothing to do but work some sixteen hours a day, solving his own complex problems!

It would be no difficult task to fill many pages with a mention of the various freak schemes that are submitted, but one or two instances must suffice as a fair characterization of all. The idea of one particular inventor was to furnish purified air to hospitals by means of a permanent captive balloon raised to a height of 5,000 feet or more, and balloon to carry an intake pipe, down which the purified air was to flow into the hospital! Simplicity itself!

ANOTHER inventor, writing from the Antipodes, had discovered after years of research a mosquito banisher (the sample smelled strongly of citronella), and was sure that if Edison contributed $25,000 to put it on the market, it would be a great success; and if he would cable money for expenses the inventor would immediately come to America to close the deal.

Another humorous side of this portion of the mail basket is provided by those ingenious persons who reinvent more or less ancient inventions. One of these caused Edison to exclaim, "I guess it would take about $25,000,000 to inform all the people in the United States of one particular thing." As this case is a good example of most of this class, the story may be interesting. A letter came from a professional man in a western state, in which the writer said he had an idea for an invention which would provide a sure and continuous income of millions of dollars. He would be glad to send particulars and Edison could put it into practice and allow the writer some of the profits. The usual courteous reply was sent, stating that Edison was too busy to consider other matters than his own and asking to be excused. By return mail came another letter from the same correspondent, acknowledging the reply but insisting that his idea was valuable and inclos-

(Continued on page 153)

BECOME AN EXPERT

ACCOUNTANT

LaSalle Extension University, Dept. 1283-H, Chicago
The World's Largest Business Training Institution

So They Wrote to Edison—

(Continued from page 164)

ing a statement of the idea, sworn to before a notary public What was it? Merely fifteen or twenty lines proposing to hitch together the phonograph and motion pictures so as to show persons in motion and hear their voices simultaneously. Not a word of suggestion or plan for accomplishing the results, but just the crude notion, in return for which he was willing to share the millions.

A letter was quickly despatched to the professional gentleman (a lawyer, by the way, informing him that he was only a quarter of a century behind the times with his idea, that Edison had conceived it in 1887.

It is to be hoped that the professional gentleman had not yet commenced to spend his part of the millions in anticipation.

ANOTHER amusing incident relating to talking movies is worthy of passing mention. One day (some months after they had been exhibited publicly) there was received a typed communication written on the letterhead of a famous club. It had evidently been dictated by a person of more than average education. It said, in effect, "How wonderful it is, Mr. Edison, that *in three months* you have succeeded in putting into practice my suggestion that you combine the phonograph and the motion picture, and have given us talking pictures." This gentleman was also informed that the idea was born and worked upon many years before it had occurred to him.

In these days of newspapers, magazines, telegraph, telephone, radio, and automobile it will be a shock to the readers' credulity to learn that Edison's mail brings in occasionally letters which suggest in all sincerity the idea of inventing and making talking phonograph dolls and phonograph clocks to announce the hour. These devices were among the earliest suggested on the advent of the phonograph fifty years ago, and were put on the market a few years afterward but did not meet with success.

AGAIN, it will tax the credulity of the reader, and at the same time provoke a smile, to learn that the man occasionally brings in a letter asking whether Edison still sends up a star in the southeast every night. Thereby hangs a tale. In the earliest days of the incandescent lamp, 1879-80, Menlo Park, N. J., where Edison had his laboratory, was a Meera for newspaper reporters. One of these facetiously reported in his paper (as an obvious joke) that Edison sent up an electric star in the southeast every evening. This humorous rumor took root and it was no uncommon thing in those early days to see people looking up into the southeast to find the "Edison Star" and, strange to say, some persons pointed it out to their friends. Stranger still, the writer of this article, while on vacation in the summer just past (1928), was asked about it in all seriousness by a person of apparently average intelligence. Rumors die hard.

At some convenient time during the day—frequently the noon hour—Edison disposes of the day's mail in his usual way. He takes up a letter, reads it, and with a lead pencil makes comments upon it as to how it shall be answered or attended to by his secretaries. It is then laid aside and the next one disposed of in a similar manner, until all are passed upon. There is not a moment's hesitation as to a reply. He masters the subject with the first reading, and his disposal of the letter follows instantly. At the bottom of the mail basket are placed letters, papers, etc., for his signature.

The reader may gain an idea of the extent of Edison's *personal* mail when it is stated that since the year 1915 more than thirty-five thousand replies to letters have been sent out from the laboratory. This figure does not include any that have emanated from any of the commercial departments of his organizations

FREE

This Genuine Draftsman's Pocket Rule

Draftsman's Pocket Rule

Get this Rule for you—this Jack!

Can you copy it? Try it. How you copy it may give me some idea of what kind of a draftsman you would be. If you are 16 years old or older and will mail me your sketch at once, I will send you free, and prepaid, a draftsman's Pocket rule just like the one shown here.

This will go to you entirely with my compliments.

I will send you also my Pay-Raising Plan and Successful Draftsmanship. Don't wait. Copy sketch now, mail to me.

Draftsmen Needed in all These Industries—Get A Job In

Auto Work | Electricity | Aviation | Steel Bridge Work | Building Work

FREE—My Pay-Raising Plan

Write to me. I will send you this new book, free & postpaid. My Pay Raising Plan and Money Making Advice. I can prove that John Terwilliger, trained by me, makes $250 a month. Earl J. Morgan, trained by me, refused $600 a month to go into business for his own boilermaking. A. H. Ramsey, trained by me earns $7000 to $8000 a year. Andrew Dorosh, trained by me, makes more than $400 a month. D. C. Hinson, trained by me, makes $475 a month. L. V. Broughton, trained by me, makes $300 a month. I can give you many more names of Dobe trained draftsmen who are making big salaries. They wrote to me just as I am asking you to write. They asked for my Free Book. They saw that opportunities in all the great industries were tremendous for draftsmen. Through drafting you can get into almost any industry you want.

Age or Lack of Education No Drawback

You do not need previous experience. You do not need to be a high school graduate. My practical, home study course gives you just the kind of training you need to be quickly successful. Your spare time is all that is necessary.

Three Money-Making Tools Furnished by Me!

You GET THESE FINE QUALITY GENUINE IMPORTED DRAFTSMAN'S TOOLS, just as soon as you become a student. No finer tools can be made for practical drafting work.

I Train You at Home, Short, Quick, Sure Way

My practical working method makes every step in learning drafting as clear as a moving picture. That's why I train you at last to be a draftsman.

Short Width Text Letters

You can start earning extra money a few weeks after beginning my training. I give you special work and tell you how to make money.

Employment Service

After training you, I help you to get a job without charging you a cent for this service. Employment of draftsmen ought to be for there because there never were more needed.

Money Back If Not Satisfied

What could be fairer than that? I don't ask you to take my chance. I train you under a positive Money Back Agreement. If my training does not satisfy you entirely, you get every penny back.

Mail Sketch—Get Free Rule

"If You Earn Less Than $70 a Week, Write Me Today"

Engineer Dobe

ENGINEER DOBE
1951 Lawrence Ave., Dept. 12-60 Chicago

Here's the sketch. Send me free rule; also send me free all 1928 issues "Successful Draftsmanship" and my "Pay Raising Plan." Let me know about drafting and proof of big money paying positions.

Name ..... Age .....

Address .....

Post Office ..... State .....

PREPARE FOR AN ART CAREER

—thru the only art school operated as a department of a large art organization, who have actually produced over a quarter million drawings for leading advertisers. Where else can you get as wide an experience? Home study instruction. Write for illustrated book telling of our successful students.

MEYER BOTH COMPANY
Michigan Ave. at 20th St. Dept. 35, Chicago, Ill.

$100 a week for TAKING PICTURES

Working in spare time, J. G. WEBB made $100 in 2 weeks. A. E. MASON earned $417 for a few days' work. YOU TOO can have quality for the wonderful opportunities in this fascinating big-pay profession.

CAMERA GIVEN

BE A MOVIE OPERATOR

We give projector and teach you at home. Big demand for movie and talkie theatres. Write for Folder.

N. Y. Institute of Photography, 10 W. 33rd St., N. Y., Dept. 3

Want Some Money?

Here's a wonderful way to get it

Our beautifully illustrated book tells how. It tells all about our new methods of art decoration, art treatment and how anybody can learn without previous training or experience. It contains page after page of handsome color illustrations of what you can do and tells how you can make good money and this book is FREE. All supplies are sent by us with the instructions and many have made $25 the first week. Some society women have taken up this work for their own amusement. Either way, pleasure or profit, it's the most delightful home work you can imagine. Write Now for your copy of this valuable book, it's FREE.

Fireside Industries

DEPT. 51-W ADRIAN, MICH.

"I *wish* I had his job"

"He hasn't been here nearly as long as I have, but he's earning three times as much. Seems to me he's the first man the firm thinks of whenever there is a good position open. Always makes good too. I wish I had started studying with the I. C. S. when he did."

Are you just wishing for a better job too? Are other men getting the promotions you'd like to have? Are you letting the precious spare hours slip by unimproved? You know as well as we do that you've got to learn more to be more. And you know, too, that the best way is right here in your home with the International Correspondence Schools. Isn't it better to start today than to wait a year or five years and then wish you had?

Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
The Universal University
Box 7483-F Scranton, Penna.

Without cost or obligation, please send me a copy of your 44-page booklet, "Who Wins and Why," and full particulars about the position, or in the subject, before which I have marked an X.

BUSINESS TRAINING COURSES

- Business Management
- Industrial Management
- Personnel Management
- Traffic Management
- Accounting and C. P. A. Coaching
- Cost Accounting
- Bookkeeping
- Secretarial Work
- Spanish — French
- Salesmanship
- Advertising
- Stenography and Typing
- English
- Civil Service
- Railway Mail Clerk
- Mail Carrier
- Grade School Subjects
- High School Subjects
- College Preparatory
- Illustrating — Cartooning
- Lumber Dealer

TECHNICAL AND INDUSTRIAL COURSES

- Architect
- Architects' Blueprints
- Building Contractor
- Architectural Draftsman
- Concrete Builder
- Structural Engineer
- Chemistry
- Coal Mining Engineer
- Mechanical Engineer
- Mechanical Draftsman
- Machine Shop Practice
- Railroad Positions
- Gas Engine Operating
- Civil Engineer
- Surveying and Mapping
- Metallurgy
- Steam Engineering
- Steam Electric Engineer
- Electrical Engineer
- Electric Lighting
- Electric Wiring
- Electric Car Running
- Electric Railway Engineer
- Telegraph Engineer
- Telephone Work
- Mining
- Navigation — Assayer
- Iron and Steel Worker
- Textile Overseer or Supt.
- Cotton Manufacturing
- Woolen Manufacturing
- Agriculture — Fruit Growing
- Poultry Farming
- Mathematics — Radio

Name .....
Street Address .....
City ..... State .....
Occupation .....
If you reside in Canada send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

Will the Insects Starve Us to Death?

(Continued from page 46)

Then, when they are ready to lay their eggs, these parasites are put in trays with the caterpillars of the gypsy moths. Shelves in the laboratory are packed with cases and trays where scientists watch these minature fighters grapped in a death-struggle with the insect enemies of man.

On a cold, dark, windy day last fall, the uncanny ability of another of these friendly fighters from abroad was demonstrated before a hundred men gathered in a borer-infested field near the Canadian line. A thousand fertilized females of an imported Ichneumon fly were released from a cage. In spite of the disagreeable day, they went straight to work. After crawling on the surface of a cornstalk near the ground, in the center of which the borers were hibernating for the winter, each would stop and deposit its eggs through the tough outer layer of the stalk. Skeptical spectators dissected some of the stalks. They marveled when they found that in every case the insect had laid its eggs unerringly on the hidden borers, where the young would hatch, enter the caterpillars, and cause their death. How these flies are able to find where the borers are hidden within the stalks is one of the mysteries of the insect world.

In its search for parasite helpers, science is encouraged by the history of the "ladybug." Some decades ago, when the fluted scale appeared in California, the Government sent to Australia for recruits to battle it. They came packed in little tin boxes, tiny black beetles with red spots, commonly known as "ladybugs."

IMMEDIATELY they developed an enormous appetite for the insects causing the scale. In the blighted orchards they were "planted," 5,000 to the acre, and later spread all over the territory. In five years, the scale that threatened to ruin the fruit growers practically disappeared from the state.

But, so far, in spite of [illegible] search, that success has not been duplicated in battling other insect foes.

The search for new ways to fight these foes, however, has given rise to a new science, called "ecology," a minute study of all the factors in the life of each destructive insect. Their habits, environment, friends, enemies, weaknesses and strong points are being recorded.

Through this study, men have learned some amazing facts. For instance, they have found that the winged female gypsy moth can't fly, but the wingless caterpillars it produces can. The wings of the moth are too small to bear its heavy body. The caterpillars, when small, are light, with an abundance of fluffy hair. They hang suspended by a thread from the tip of a high branch. When a wind comes along strong enough to break the thread, it carries them sailing away, sometimes for several miles. The gypsy moth had been studied for thirty years before this solution of the mystery of their rapid spread became known.

EACH of our winged and crawling foes in the insect world has to be studied individually. Each species of insect, in its life and habits, varies somewhat from others and may offer a vulnerable point where it may be attacked. For this reason, biological observations in connection with insect control operations are highly important. Roughly there are two general classes of insecticides, the contact sprays, such as lime-sulphur wash, nicotine, soaps, kerosene emulsion and the like for sucking insects, and the arsenical or stomach poisons for insects, such as caterpillars and beetles, which actually eat the foliage of plants. Some insects may be attracted by plant odors, or repelled by disagreeable smells.

The Japanese beetle, for example, outwitted attacks that succeeded (Continued on page 158)

Be an Electrical Specialist. Unusual opportunities in this fascinating work. Thoroughly practical course prepares men, 16 and over, for Technical and Executive positions. Learn at National—world-famous school in Los Angeles. Unlimited chances for advancement in California. 32 instructors. Unexcelled equipment. 24th successful year. 17,000 active graduates. Highest type training—practical—intensive—condensed for quick results. Endorsed fully by electrical industry and vocational authorities. Nominal entrance requirements. Free Employment Service during and after graduation. California now spending $100,000,000 in electrical development. Large, illustrated electrical training Catalog explains everything. Don't miss getting your copy. Free and postpaid. Send name and address on coupon NOW.

FREE BOOK

NATIONAL ELECTRICAL SCHOOL
Dept. 28-Radio Institute 4006 ANGELUS, CALIF.

DEVELOP POWER
AT HOME

In Politics, government, or business carry on through life your education, earn credit toward a Bachelor degree, by using the 640 courses

The University of Chicago
Gives by Correspondence

Inquire or check the coupon in proper degree and mail to 561 Ellis Hall, University of Chicago, Chicago, Ill.

Foreign Work!

Like to Travel—Dear Romantic, Wealthy South America call you? Unusual opportunities for young men. American employers. Fare and expenses furnished. BIG PAY. *Write for Free List.*

SOUTH AMERICAN SERVICE BUREAU
14000 Ring Avenue Detroit, Michigan

FREE 352-Page Catalog
OF BOOK BARGAINS!

THE BOOK SUPPLY COMPANY, Dept. 1B
564-566 West Monroe Street Chicago, Illinois

Book on Law Free

Write today for this new book. It tells you how a few training will shorten your road to success. It also contains a vital and inspiring message to every ambitious man. Find out about the opportunities that await the law trained man. Find out how you can learn law right in your own home in spare time. The book is absolutely Free.

Write Today—[illegible] School of Law Dept. Chicago, Ill.

A definite program for getting ahead financially will be found on page four of this issue.

Will the Insects Starve Us to Death?

(Continued from page 151)

against most of its fellow fighters against man's dominion. When a tree was sprayed with poison, the beetle flew away to another tree. It refused to touch poisoned leaves until the insecticide had lost its power or rain had washed it away. The orchardists were in despair until they learned that what catnip is to cats, the oil of geranium and manafras is to these beetles. When a tree was sprayed with it, the odor brought the beetles from miles around, and a spray of geranol, which kills by contact, dispatched them all.

In spraying another sort of insecticide over the cotton fields of the South, a strange thing happened which still mystifies science. When sprayed from the nozzle of a hose, the particles refused to spread evenly over the plants, but when the dust was scattered by the propeller of an airplane skimming fifteen feet above the ground, there was no trouble. A theory has been advanced that static electricity is the cause of the phenomenon. The minute particles of poison dust swirling through the nozzle of the spray gun were given, by friction, an electrical charge, and these charges, being mixed, attracted each other, with the result that the particles formed little clumps of ten or a hundred. Propeller-blown dust, according to the theory, is without such charges and so spreads evenly.

From different points along the battle line comes news of inventions and discoveries that may help in the fight. One such aid spies out hidden retreats of insect enemies with a super-delicate instrument which enables us to hear minute insects working deep in masses of stored grain or under the bark of trees!

IN THE South, a dragonlike machine, breathing poison smoke, has been tried with success as a boll weevil exterminator. Powder burns slowly in the fire box, and as the machine moves down the rows, heavy smoke is blown into a moving tent at the rear. This tent keeps weevils from escaping before they are overcome and at the same time protects the driver and horses from the fumes. The insects, larvae, and fruit molds that menace carload shipments of fruit from California are being eliminated by a new product of a western chemical company. Water, at a temperature of 140 degrees F., brings liquid sulphur dioxide, in heavy steel containers, to a high pressure. The killing gas is released inside the cars of fruit and in twenty minutes the danger of hidden insects ruining the shipment is over.

Near Chicago, a motorcycle carrying thirty-two gallons of heavy oil in a vapor sole-carrier patrols a district of seventy-six square miles during summer months, fighting mosquitos at their breeding places. Another weapon, tried successfully in the forests of central Europe against the nun moth, may be tried here. Huge searchlights, flanked by flaring arc lamps, attract the moths. They collect in the arc lamps and are killed by being drawn violently into boxes by blowers.

But in spite of the many minds bent upon stemming the rising tide of insects, it has held its own or continued to advance. The struggle, increasing in importance as population grows, is one that will require all the resources of science for man to win.

A Great Story You'll Enjoy

YOU'LL be thrilled and entertained by John R. McMahon's great story of the Wright brothers, beginning next month. Full of facts and anecdotes never before published, it will give you for the first time a dramatic inside picture of the struggles and triumphs of the two young inventors as they tried their wings

GET INTO ELECTRICITY

Learn-by-Doing in 90 Days

Experience, Advanced Education Not Needed

Earn While You Learn

Many COYNE Men Earn $60 to $200 a Week

Not Books—All Practical Personal Training

FREE BOOK MAIL COUPON TODAY

H. C. Lewis, Pres.
Coyne Electrical School
500 S. Paulina Street, Dept. 28-73 Chicago, Ill.

Name _____
Address _____
Town _____ State _____

Get My Complete Story

COYNE ELECTRICAL SCHOOL
H. C. Lewis, Pres.
500 S. Paulina St., Dept. 28-73 Chicago, Ill.

A definite program for getting ahead financially will be found on page four of this issue.

ELECTRICITY — PAYS BIG!

LEARN IN 90 DAYS
ON ACTUAL MACHINERY — NO BOOKS

I'LL PAY YOUR R.R. FARE TO CLEVELAND

Earn $60.00 to $100.00 a week—and hold your head as high as the best man. You can do it easily in amazingly few weeks and back in only years of practical knowledge. You work shoulder to shoulder with expert instructors on full-sized, moving, whirling motors, generators, bat eries, switchboards, telephone and telegraph systems, etc. We are McSweeny trained men get the biggest paying jobs. Every day I receive requests for graduates.

Big Book Sent FREE

Today! Right now take the first step out of that low pay rut. Mail the coupon for my big illustrated book on Electricity. It's free postage. Get my special Railroad Fare offer and Remarkable Tuition offer.

No Education or Experience Needed Employment Department Helps You!

No books to read. No dry lectures to listen to. You learn by doing. I don't care if you can't tell a motor from a horse-and-buggy now. When you graduate I guarantee that you'll know electricity from A to Z. If you're not fitted to fill a big-pay job I'll refund every penny of your tuition.

I help my students find spare time jobs while they are in school and my Employment Department assists my graduates to locate good positions after graduation. McSweeny trained men are in demand.

Just Mail Coupon!

J. H. McSweeny Pres.
McSweeny Electrical School
Dept. 52-T Cleveland, O.

Dear Mac. Without obligating send me a copy of your big book. Tell me also about your offer and details of employment service.

Name _____
Address _____
Town _____ State _____

McSweeny Electrical School
Dept. 52-T Cleveland, Ohio

It's only a matter of hours now, before you can get started in—

AVIATION

Hundreds of Men are Proving It—this Tested Way!

THERE'S a better Job and a bigger Future for YOU in Aviation! What's more, it doesn't call for "pull" or for a big outlay of cash to get started NOW. Already hundreds of level-headed men have taken Hinton Training, gotten the knowledge that employers are eager to pay for, and today they are sharing in the growth and profits of America's fastest-growing industry!

Get Hinton's FREE Book

Hinton's FREE Book tells exactly how he trains you right at home in every branch of the Industry. It's only a matter of hours now spared nor hours before you can be ready. For every hour of study that you give his time may Course, he'll give you a complete knowledge of plane design, repair, upkeep, motors, ignition, "Rules of flight, navigation, instruments, management—every fact you need to really make something of the Aviation opportunity that's ready for you as soon as you are ready for it.

Get the full facts about our Employment Dept. about special reduced rates on Flying Instruction, if you want it, about the amazing opportunities for men in over 50 trades, on the ground and in the air. Now it's your turn to LEARN. Your first step is the coupon below. Clip it, sign it—SEND IT TODAY.

Aviation Institute of U. S. A.
Walter Hinton, President
1115 Connecticut Ave.
Washington, D. C.

MAIL NOW!

WALTER HINTON, Pres. 2-M
AVIATION INSTITUTE OF U. S. A.
1115 Connecticut Avenue, Washington, D. C.

All right! send me that FREE Book showing how you'll train me right at home in my spare hours for quick success in Aviation Training.

Name

Street Age

City State

Romance Rides in the Air

(Continued from page 35)

not determine the proper direction to take, so he just guessed at it.

Running down the mountain to keep from freezing, he slipped on a rock and rolled for yards and yards. The jolt was lucky. He felt his shoulder snap back into place!

For those who know the high standard of loyalty in the air mail, it is needless to add that Scott did not neglect to hang on to the mail, which he got through to a train.

A mingling of the sublime and the ridiculous! But what else is life? And life up in the clouds is life intensified a thousandfold.

Thrills and laughter, too, are mixed in generous doses in the story of the sardine-catching adventures of J. D. Hill, the gallant airman who afterward was lost with Payne and Bertaud in their tragic attempt to fly to Rome. The unexpected had played surgeon to Scott, it made an unwilling fisherman out of Pilot Hill. But here is the tragi-comedy in Hill's own words.

"I TOOK off about 12:10 at Garden City, pyrene hitting the back of my legs suggested a rough trip. . . . I crossed the Delaware at Trenton and what had been bad became worse. Rain became more rain, more rain became water. I discovered that one gray patch was trees, another water, and still another clouds. Every time I saw a 'W' on the compass I headed for it.

"There were no automobiles on the roads, no birds, but millions of little things began to whiz by me, and as a fairly big one went by I looked back quickly and saw a fin and realized they were fish. All those little ones must have been sardines, and I never knew before they grew close together like that.

"Anyway, there I was with a fire extinguisher and a manchester pressing for a Midget. I saw a line of automobiles that seemed natural enough, but that band of flowers and the pipe organ were queer.

"I got back into clear water, rose a bit, and finally came out to where it was only raining. I saw fields, and after a time sat down in one. A man came out of a barn and said Lancaster was only sixteen miles west. . . cold, wet, and hungry, and I never got a gol-darned fish!

"Sixteen people were drowned in Pennsylvania that day, and I suppose I would have drowned, too, if it hadn't been for the fan on the front of my ship. My observation on that trip was that the D. H. has too many wires for an airplane and not enough for a fish net!"

THERE is an eerie, dreamlike quality in this unadorned little tale.

There was a glad awakening in the field—the reassuring voice of the farmer, the dry clothes and hot food that came in due time, and the mail that was, of course, delivered.

But of whatever ghastly nightmare he went through on his way to Rome, Hill never saw the end. That time there was no awakening. The unexpected on that trip was on the side of the fish and the water.

Adventure rides the sky with every man who leaves the surface of the earth. Every precaution may be taken, and still a tiny trick of fate may quench the brightest flame of life.

A reserve air mail pilot was caught one night in a snowstorm over Iowa. Losing the route, he decided to jump with his parachute. He pulled the lever which sent a flare slipping down at the end of a smaller chute. It fell and illuminated about a square mile of flat country whitened with the snow and brilliant light. Then the flyer jumped. But he had pulled the rip cord of his own parachute just a bit too quickly. It snapped open before clearing the plane. The shroud lines were caught in the tail and cut apart. The pilot dropped like a brick. Searching pilots found the wreck. Some distance from the

(Continued on page 157)

$25.00 DRAWING COURSE for $2.98

Haven't you often wished that you could draw cartoons, ads, are some like, sketch some pretty face, etc.? You can do all of these things. One of America's most famous cartoonists and illustrators has developed a great simple system for success in all branches of Commercial Art. This system has at last combined the entire theory of drawing, so simple that drawing can be as easy for you as writing. Much simpler than learning shorthand, bookkeeping or typewriting. We are now placing this original system for learning Drawing, Art and Illustrating, consisting of 20 lessons with over 300 illustrations within reach of every one. If you will devote a few hours each week to the course We Absolutely GUARANTEE that you will learn to draw and draw well before you are half finished the course. If we fail to make you a success we will refund every cent paid us. By eliminating a large office force and advertising, corresponding expensive salesmen, etc., we are enabled to make a price of $2.98. The regular price of course for a short time only is $25.00.

Many have said we are very similar to that of Bob's F... [illegible] ... can see how you get so much for the money. Others with lesser courses get from $20 to $50 for theirs. It is more than I expected. I start to draw. It is a big asset no matter what you do in life.

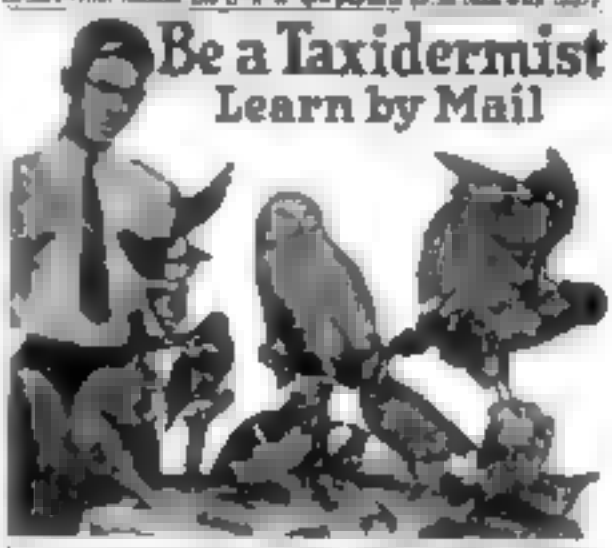
Send No Money

Just write the coupon, and $2.98 in full payment. We will include a drawing outfit consisting of artists pencils, paper, eraser, compass, triangle, blender, etc., enclosing free to you without extra charge. Mail coupon today.

If you prefer to send cash with order we will include a drawing outfit consisting of artists pencils, paper, eraser, compass, triangle, blender, etc., enclosing free to you without extra charge.

LIEBERT SCHOOL OF DRAWING, Dept. 284-B, Chattanooga, Tenn.

Be a Taxidermist
Learn by Mail



Learn to mount all kinds of game, birds, animals. Save your fine trophies. Decorate your home with beautiful specimens that you have caught and mounted yourself. You can make big money doing this work for others. Many specimens are becoming very rare and high in price. Over 100,000 students have learned taxidermy through our home study method. Many make their entire living mounting specimens. Others make it a profitable spare time hobby. Write today for our interesting and valuable book. It's free. Learn how to mount birds, animals, game heads, fish, rugs, etc. Learn how to tan skins and furs. Learn how to start in business for yourself. Many of our graduates are now successful taxidermists. Write today for our interesting and valuable book. It's free. Learn how to mount birds, animals, game heads, fish, rugs, etc. Learn how to tan skins and furs. Learn how to start in business for yourself. Many of our graduates are now successful taxidermists.

Mount Your Own Specimens

Decorate your home with beautiful specimens that you have caught and mounted yourself. You can make big money doing this work for others. Many specimens are becoming very rare and high in price. Over 100,000 students have learned taxidermy through our home study method. Many make their entire living mounting specimens. Others make it a profitable spare time hobby. Write today for our interesting and valuable book. It's free. Learn how to mount birds, animals, game heads, fish, rugs, etc. Learn how to tan skins and furs. Learn how to start in business for yourself. Many of our graduates are now successful taxidermists.

FREE Beautifully Illustrated Book—"How to Mount Game" Explains the wonderful Butterfield System of mounting all kinds of specimens. Every hunter or trapper should have this book. Write today for our interesting and valuable book. It's free. Learn how to mount birds, animals, game heads, fish, rugs, etc. Learn how to tan skins and furs. Learn how to start in business for yourself. Many of our graduates are now successful taxidermists.

Northwestern School of Taxidermy 3943 Elwood Bldg., Omaha, Nebr.

BE A DETECTIVE

Make Secret Investigations
Earn Big Money. Work home or travel.
Particulars FREE. Write Dept. P 8.

AMERICAN DETECTIVE SYSTEM
2190 Broadway New York
Name.
Address

WE MATCH PANTS

To Any Suit!
Double the life of your coat and vest with perfectly matched pants, 100,000 patterns. Every pair hand tailored to your measure; no readymades. Your match sent FREE for your O. K. before pants are made. Fit guaranteed. Send given at right or your today.
WESTERN MATCH PANTS COMPANY
Dept. 140 Chicago

BOYS Earn Men's Wages as AUTO MECHANICS

Boys 16 to 21 are needed everywhere in spare time and during vacations to learn the Cleveland Auto Method and earn more than $1,000 a year. Only a few months of fascinating training at your home. Then we help you get a position. No books or lectures. Learn on real automobiles. Employment help given. Write today for interesting booklet and free offer. Ask for Big Pay Book.

Cleveland Auto School, Dept. B-31, Cleveland, O.

Romance Rides in the Air

Continued from page 156

plane was the mutilated body of the reserve.

Luck, fate, call it what you will, but always—the unexpected.

Do you like turnips for breakfast? Do you ever expect to eat them in the cold, gray dawn? Of course you don't, and neither did Harry G. Smith, flying between Cleveland and New York for the National Air Transport. Yet he had to; and because of an experience he had in being forced down in the Alleghenies, he is known to his friends as "Turnips" to this day.

South a motor slowed up just as he reached the mountains, so that he couldn't get altitude to climb over them.

"I had enough power to keep flying by gradually losing a little altitude," he said. "The wind was so strong that I could not turn against it back to the last emergency field, and the mountains were so high a few miles ahead of me that I couldn't get over to the next field, so all I could do was to turn off the course and try to find a clear spot. This I did. It was dark, and by using a parachute flare I landed the ship without any damage.

"IT WAS very cold—about ten below zero, and a thirty-mile wind was blowing. I drained out several gallons of gasoline from the tanks and poured it over an old tree stump and made a fire. I thought that if there was any one in that part of the country it would attract attention. The wind, however, was so strong that the fire would go out as soon as the gasoline burned."

There was no way out for Smith but to walk, guided by the stars and his compass. At last he found a deserted cabin, and, there he camped for the night. Kicking against something on the ground, he found it was a frozen turnip. He thawed it out, boiled it, and had turnip for breakfast.

"And the worst of it is," remarked Pilot Smith when he got back to civilization, "that I never did like turnips, at any time!"

Perhaps the classic among all yarns concerning the unexpected-in-the-air is the laconic report of an air mail pilot, Dean Smith, now a member of Byrd's Antarctic Expedition.

"Dead-sticked—flying low—only place available on cow—killed cow—wrecked plane—scared me—Smith."

It was the cow that died that time, and lucky Smith was saved. But we all know, alas, that many, too many, do not share Smith's good fortune. In ten years of air mail service, thirty-two pilots lost their lives. They went up into the clouds in quest of high adventure. They gambled and lost.

STATISTICS prepared by postal authorities may prove that the percentage of loss of life is low when the number of men in the service, the period of time, and the hazards are considered. But mothers and wives and children are not comforted by figures.

Think for a moment of the mother of Brooke Pearson, who received this letter written by her son after he had crashed in a fog:

"Dear Mother:

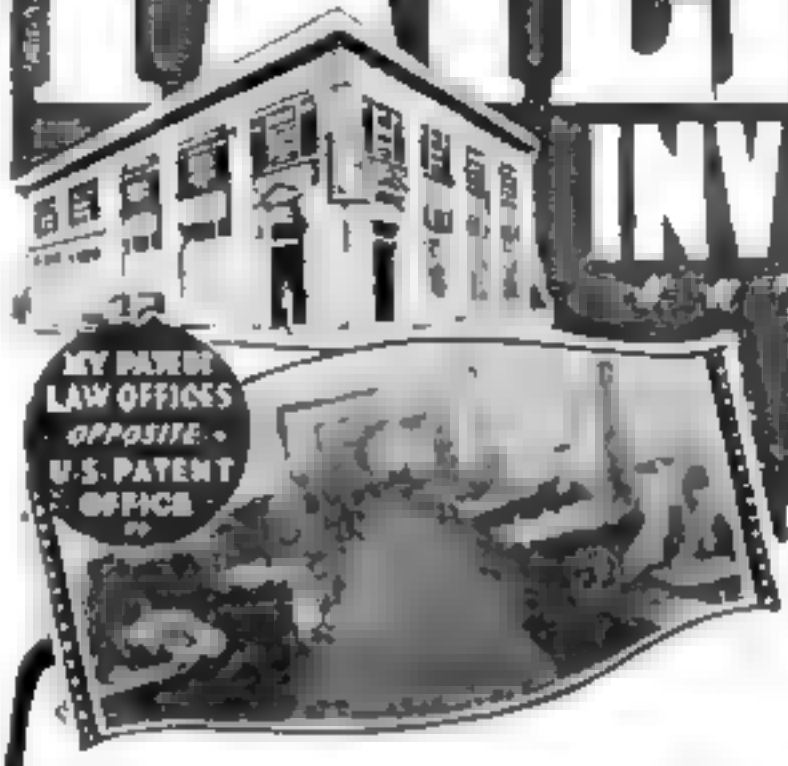
"I trust your eyes may never see this, but should God desire that you do, you at least know He has called me like many more who have given their lives for the future of this wonderful game. I was possibly wrong in not giving it up; possibly I might have thought the same, but I chose to keep at it and only pray that something of me has been learned.

"The world in general calls us silly fools, but it's the silly fools who make the sacrifices that help to perfect any great thing that the world in general greatly benefits by later.

"My dearest mother, I say farewell, au revoir, for a time only, as I hope we will meet again. Keep a brave heart. I pray God to look after you, as you have struggled as no other mother has to make.

(Continued on page 158)

PATENTS
INVENTORS
Write for these FREE BOOKS!



At the left is a view of my drafting and stenographic offices where a large staff of experienced experts is at my constant service. All drawings and specifications are prepared under my personal supervision.

Protect Your Ideas

Take the First Step Today

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

Strict Secrecy Preserved—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in fireproof steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. If ghost references. But FIRST—MAIL the coupon and get my free book. Do THAT right now.

Prompt—Careful Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

No Charges for Information on How to Proceed

The booklet shown here contains valuable information relating to patent procedure that every inventor should have. And with it I will also send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Clarence A. O'Brien
Registered Patent Attorney

Member of Bar of Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims.
Practice confined exclusively to Patents, Trademarks, and Copyrights.

Mail this Coupon *now!*

Clarence A. O'Brien
Registered Patent Attorney
508 Security Savings & Com. Bank Bldg.
Washington, D. C.

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name

Address

(Important: Print or Write name clearly)

Magic

Learn at Home —by Mail!

Quickly! Easily!

New! Different! Dr. Harlan Tarbell, Famous Magic Wizard, teaches you Big Tricks, Illusions, Stage Stunts, "Patter" and the Principles of Magic. You learn easily and quickly at home by mail. Earn $250 to $1000 a month. Write today for big *free* Magic Book.

Astonish Your Friends

Gain that magnetic popularity that makes you the center of any crowd. Business and social success is assured the man who can perform mystifying tricks. You can earn big money either on the side or as a professional, as well as being the most popular person in your crowd. Why envy others' skill? You can learn Magic yourself, quickly, easily — at home — by mail — during your spare time.

Earn $250 to $1000 a Month

Magic is *Now* made simple to learn. For Dr Harlan Tarbell, one of the really Great Magicians, has finally opened up the secrets of his profession in a completely illustrated course offered at a merely nominal cost. You will be able to mystify and entertain your friends with simple tricks taught in your very first lesson. Dr. Harlan Tarbell takes you through the entire maze of sleight-of-hand, card tricks and elaborate stage divertisements. The apparently superhuman doings of the accomplished magician become as simple as ABC when you just know how.

Write! Mail coupon now for big free Magic book telling all about the great Tarbell Course in Magic. Get Our Low Prices and Easy Payment Plan.

Tarbell System, Inc., Studio 12-49
1920 Sunnyside Avenue, Chicago, Ill.

Gentlemen: Without any obligation, send me your free literature and information all about your wonderful "Tarbell Course in Magic." Also tell me about your Low Prices and Easy Payment Plan.

Name .....

Address .....

..... Age .....

Romance Rides in the Air

ends meet. 'It's always darkest just before the dawn.' I. L. Y. A.

"Brooke."

And to his fellow-pilots this gallant soul bade farewell in these inspiring words:

"My Dear Friends.

"I go West, but with a cheerful heart. I hope what small sacrifice I have made may be of use to the 'game.' When we fly we are damned fools, they say; when you're dead you weren't half a bad fellow.

"Every one in this wonderful aviation is doing the world far more good than they appreciate.

"We risk our necks, give our lives, to perfect an invention for the benefit of the world at large, so that they may benefit in years to come. They, mind you, are the very ones who call us fools.

"Stick to it, boys. I'm still very much with you.

"See you all again.

"'Jap' Pearson."

THE unexpected killed Brooke Pearson. And again its name was fog. Perhaps no human agency will ever be contrived to subdue the elements and eliminate all natural hazards from flying. But there is bright hope that fog, the airman's most treacherous enemy, will soon be laid low. The most recent challenge came the other day from the Guggenheim Fund for the Promotion of Aeronautics, Inc. The Fund announced that it will establish a full-flight laboratory on a section of an established airway, where fog-flying under regular operating conditions can be studied. An experienced pilot of engineering and scientific training will be in charge of the experiments. As consultant to the Fund, Colonel Lindbergh will be special adviser to the enterprise.

Shortly after this announcement the First National Aeronautical Safety Conference was held in New York City under the joint auspices of the Guggenheim Fund and the National Safety Council.

Such leaders in the flying world as Harry F. Guggenheim, president of the Guggenheim Fund, Colonel Lindbergh, General James E. Fechet, U. S. A., chief of the Army Air Corps, Rear Admiral W. A. Moffett, U. S. N., chief of the Bureau of Aeronautics of the Navy Department, Charles L. Lawrance, inventor of the famous Wright Whirlwind engine, president of the Wright Aeronautical Corporation, Paterson, N. J., Prof. Alexander Klemin, of the Daniel Guggenheim School of Aeronautics, New York University, Dr. L. H. Bauer, medical director of the Air Regulations Division of the Department of Commerce, Wesley L. Smith, noted pilot and superintendent of the Eastern Division of the National Air Transport, Inc., of Cleveland, took part in the discussions.

THE safety problem was attacked from the meteorological, structural, mechanical, navigating, operating, and medical points of view. And all of the technical discussions had but one ultimate purpose—to minimize the unexpected-in-the-air.

Adventure rides in the sky and always will. Man was not born with wings. So long as he sets out to conquer an alien element will he encounter risks and hazards without number.

But there happily is hope that, after all, "Jap" Pearson, "Merry" Merrill, and the many other members of the Silent Squadron who have flown Beyond, may not have died in vain.

BEGINNING next month! The true story of the Wright brothers; hitherto unpublished facts revealed for the first time in a thrilling series of articles that read like a novel. Order your copy now.

PATENTS
TRADE-MARKS
SERVICE

Without charge or obligation we will inform you as to any questions you may put touching on patent, trade-mark and copyright law. You may ask: "Should I protect myself by patent or register under the trade-mark or copyright laws?" "What kind of a patent should I obtain?" and many other questions that may occur to you. These are vital points to consider and questions will be cheerfully answered.

Don't Lose Your Rights To Patent Protection

Before disclosing your invention to any one, send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of their ideas. The form "Evidence of Conception," samples, instructions relating to obtaining of patents and schedule of fees sent upon request.

LANCASTER & ALLWINE
370 Ouray Building
Washington, D. C.

Originators of forms. Evidence of Conception.

PATENTS
TO THE MAN WITH AN IDEA

PATENTS Procured. Trade Marks Registered. A comprehensive, experienced prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request.

IRVING L. McCATHRAN
PATENT LAWYER
Formerly with and successor to Richard B. Owen
301 Owen Building, Washington, D.C.
41-D, Park Row, New York City

TRADE MARKS REGISTERED

PATENTS

Trade-marks, Copyrights, Patent Litigation, Handbook with illustrations, 100 mechanical movements. Sent free on request.

ALBERT E. DIETERICH
Formerly member Examining Corps U. S. Patent Office
Registered Patent Lawyer and Solicitor
30 years' experience
581-A Ouray Bldg. Washington, D. C.

PATENTS

BOOKLET FREE — HIGHEST REFERENCES
PROMPTNESS ASSURED — BEST RESULTS
Send drawing or model for examination and advice.
WATSON E. COLEMAN, Patent Lawyer
724 Ninth Street, Washington, D. C.

PATENTS

As one of the oldest patent firms in America we give inventors at lowest consistent charges, a service noted for results, evidenced by many well known Patents of extraordinary value. Book, Patent-Guide, free. Lacey & Lacey, 648 F St., Wash., D.C. Estab. 1869.

Killing Fires in the Air

(Continued from page 50)

heat around three of the supporting columns of the building. These columns were hollow iron castings, fourteen inches in diameter, and were unprotected by any kind of fireproofing. A better setting for tragedy cannot be imagined, and I knew we were in for trouble. I had barely got my men out of the building when the three unprotected columns buckled and collapsed, bringing down the entire eight stories above them in a huge pile of debris.

"Had these columns been of steel, covered by two inches of cement plaster or other fire insulation, firmly anchored to resist fire and water, the Butler Brothers fire would have been just a simple packing room blaze, extinguished without difficulty. But because these supporting pillars lacked fifty dollars worth of fireproofing, a loss of $650,000 resulted. True, the building was comparatively old; I doubt whether such a situation could exist in a new building, where the fire underwriters insist that all supporting columns be covered by terra cotta, cement, or some other fire-resistive material."

ANOTHER major lesson learned by modern fire-masters is the science of penning a fire into a relatively small area. "A good big fire is harder to knock out than a good small one," is Kenlon's characteristic way of putting it. By the use of fire doors, fire walls, and wired glass windows, many a ravenous blaze not only has been kept from spreading, but has been forced back upon itself, hemmed into a confined area, and easily extinguished.

The Asch clothing factory fire of 1911 first called Kenlon's attention to the tin-clad fire door as an effective means of checking the progress of flames in congested building areas. In that terrible conflagration, 200 lives were lost, and the factory in Washington Place was entirely demolished. After the fire Kenlon noticed, high up on the blank brick wall of an adjoining building, a single fire door guarding the only entrance between the burned building and its neighbor. On inspection, this doughty protective device proved to be a door of soft pine, covered with a single sheet of twenty nine-gage tin! Its staunch defensive qualities gave Kenlon an idea. If a cheap tin door could prevent a vicious fire from leaping from one building to another, why not arrange a series of doors between the various parts of the same building?

A conference with the New York Board of Underwriters showed that they were working on a similar plan. The result of combined effort was given a practical trial in the new Equitable Building. This structure was divided from subcellar to roof by four vertical fire walls. Theoretically, a fire could gut one of these vertical compartments, yet leave the other three untouched. These fire walls were pierced with tin-clad fire doors, which automatically closed themselves when the temperature reached 136 degrees. The efficiency of these fire walls and doors has already been noted.

THE opposite extreme—a vast open area, unprotected by fire walls—still exists in old-type buildings. As an example, Chief Kenlon cited the Jay A. Mellish warehouse fire of November 16, 1927. This three-story edifice, at 613 West Fifty-Ninth Street, was of ordinary brick construction and was being used as a storage warehouse for new automobiles. At the time of the fire, 2,500 brand-new cars were stored in the building.

"From the fire-fighter's point of view," said Kenlon, "the worst feature of the warehouse was two huge unbroken floor surfaces, one of 56,000 square feet and the other 19,000 square feet, divided only by a single brick wall. Why, lots of forest fires can't (Continued on page 160)

PATENTS TRADE-MARKS AND COPYRIGHTS

OUR OFFER: FOR THE PROTECTION OF YOUR INVENTION

YOUR FIRST STEP. The inventor should write for our blank form—**"RECORD OF INVENTION."** This should be signed, witnessed, and returned to us, together with model or sketch and description of the invention for INSPECTION and ADVICE FREE!

Our FIVE Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents, Our Methods, Terms, and 100 Mechanical Movements illustrated and described

OUR TRADE-MARK BOOK

Shows value and necessity of Trade-Mark Protection. Information regarding *Trade-Marks and unfair competition in trade,*

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries and secure Foreign Patents in shortest time and at lowest cost.

PROGRESS OF INVENTION

Description of World's Most Pressing Problems by Leading Scientists and Inventors. All Communications and Data Strictly Confidential. Interference and Infringement Suits Prosecuted.

DELAYS ARE DANGEROUS IN PATENT MATTERS

IMPORTANT! To Avoid Delay!

YOU SHOULD HAVE YOUR CASE MADE SPECIAL IN OUR OFFICE to save correspondence, secure protection and early filing date in the Patent Office. To secure *special preparation* of your case send $25.00 on account with model or sketch and description of invention.

Our Lawyers Practice in all U. S. Courts and defend Clients in Suits involving Patents, Trade-Marks and Copyrights

OUR ORGANIZATION OFFERS PERSONAL SERVICE

By Experienced Patent Lawyers, Solicitors, and Draftsmen

We regard a satisfied client as our best advertisement, and furnish, upon request, lists of clients in any state for whom we have secured patents.

Highest References —Prompt Service—Reasonable Terms

WRITE TODAY

FREE COUPON

VICTOR J. EVANS & CO.

Registered Patent Attorneys

MAIN OFFICES: 690 Ninth St., Washington, D. C.

BRANCH OFFICES: 1007 Woolworth Bldg., New York City; 618-619 Liberty Bldg., Philadelphia, Pa.; 514 Empire Bldg., Pittsburgh, Pa.; 1114 Tacoma Bldg., Chicago, Ill.; 1010 Hobart Bldg., San Francisco, Calif.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name. . . . . .

Address . . . . . .

The only man who could talk to the Superintendent

"Soon after I began studying," a student wrote to us the other day, "we had a change in management at our plant. I certainly was glad then that I had decided to study in my spare time. For, thanks to my I. C. S. course, I was the only man in the organization who could talk to the Superintendent in his own language. As a result, I was promoted over men who had been here from ten to twenty years. My salary has been increased 90 per cent in the last ten months."

That's a true story of what just one I. C. S. student has done. There are thousands of others. Every mail brings letters from men and women telling of promotions and increases in salary due directly to spare-time study.

One hour a day, spent with the I. C. S. in the quiet of your own home, will prepare you for success in the work you like best. *Yes, it will!* Put it up to us to prove it.

Mail the Coupon Today for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 2184-F Scranton, Penna.

Without cost or obligation on my part, please send me a copy of your booklet, "Who Wins and Why," and tell me how I can qualify for the position or in the subject before which I have marked an X

BUSINESS TRAINING COURSES

- Business Management
- Industrial Management
- Personnel Management
- Traffic Management
- Banking and Finance
- Accountancy (incl. C.P.A.)
- Cost Accounting
- Bookkeeping
- Secretarial Work
- Spanish ☐ French
- Salesmanship
- Advertising
- Business Correspondence
- Show Card Lettering
- Stenography and Typing
- English
- Civil Service
- Railway Mail Clerk
- Mail Carrier
- Common School Subjects
- High School Subjects
- Illustrating ☐ Cartooning
- Lumber Dealer

TECHNICAL AND INDUSTRIAL COURSES

- Architect
- Architectural Draftsman
- Building Foreman
- Concrete Builder
- Contractor and Builder
- Structural Draftsman
- Structural Engineer
- Electrical Engineer
- Electrician
- Electric Lighting
- Electric Car Running
- Telegraph Engineer
- Telephone Work
- Mechanical Engineer
- Mechanical Draftsman
- Machine Shop Practice
- Toolmaker
- Patternmaker
- Civil Engineer
- Surveying and Mapping
- Bridge Engineer
- Gas Engine Operating
- Automobile Work
- Aviation Engines
- Plumbing and Steam Fitting
- Heating and Ventilation
- Sheet Metal Worker
- Steam Engineer
- Steam Electric Engineer
- Marine Engineer
- Refrigeration
- R. R. Positions
- Highway Engineering
- Chemistry
- Coal Mining Engineer
- Navigation ☐ Assayer
- Iron and Steel Worker
- Textile Overseer or Supt.
- Cotton Manufacturing
- Woolen Manufacturing
- Agriculture ☐ Fruit Growing
- Poultry Farming
- Mathematics ☐ Radio

Name .....

Street Address .....

City ..... State .....

Occupation

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada.

Killing Fires in the Air

(Continued from page 159)

claim a start like that." The fire followed an explosion in a motor boat that was being prepared for winter storage. A falling tool struck sparks from a metal engine part, igniting some gasoline in the bottom of the boat. A blinding explosion hurled burning gasoline into all parts of the wooden-beamed warehouse, and before [illegible] could get into action, the whole building was enveloped in smoke and flame.

Kenlon arrived at a second alarm. Seeing that it was impossible to salvage a single automobile from the inferno, he turned his attention to preventing the spread of the fire among old buildings near by. There were no fire walls nor fire doors to help him in this task, but by converting the [illegible] with three huge water towers and the heaviest hose artillery at his command, he subdued the fire by the old-fashioned method of "drowning" it. The owner of the warehouse was lost in the fire, and 2,500 automobiles were destroyed. The property loss was $500,000—which might have been quartered if suitable fire stops had been erected to check the rapid spread of the flames.

"LET me define fire prevention in modern terms for the readers of Popular Science Monthly," Chief Kenlon said to me at the close of our interview. "Of course everyone is familiar with the educational propaganda of the public schools and large industrial corporations in spreading the doctrine of 'Fewer Fires.' We all know that we must not smoke in bed, toss matches about carelessly or use gasoline to clean clothing beside a lighted gas jet. But even if we could exercise due care at all times and places, there would still be a constant fire menace surrounding us on all sides. The increased use of gasoline, electricity (with the danger of short-circuiting), celluloid films in moving picture houses and a thousand other hazards arising from industrial and domestic practices, lays our civilization wide open to the fire peril.

"I believe human nature and modern society are so constituted as to make the literal prevention of fires impossible. Granted, then, that fires will always get started somehow, it becomes our task to *prevent them from spreading!* The new science of fire prevention is developing along this line. Take, for instance, the introduction of wired window glass, set in hollow steel frames. Until wired glass was used, most fires would burst through ordinary glass windows, and lick its way up the outside of the building. Or it might leap across a street, setting fire to a structure on the other side. But there are mighty few fires that can break through the modern fire-resistive window and that means fewer fires getting beyond control.

"PERHAPS the most important 'preventer' of fires developed during my forty years' experience is the automatic sprinkler. In 10,000 fires a year the Department is materially aided in putting out nasty blazes by its successful operation. It sounds an alarm and releases a shower of water upon the fire, checking it until we arrive. I can truthfully say that where there are no sprinklers, there is no adequate fire protection.

Incidentally, Chief Kenlon is the inventor of a sprinkler device particularly successful in heated warehouses and other low-ceiling buildings where storage space does not permit the use of ordinary sprinkler pipes and outlets. His invention resembles the whirling spray used on suburban front lawns. It is located in the center of the ceiling, and is set whirling by the breaking of a fusible link, which melts when the temperature of the room rises above a given temperature, usually 135 degrees. It hurls six streams of water to all corners of the room, and has an

(Continued on page 161)

$85 a Week for McCarty

$278 Extra for McGriff

$100 [illegible] for Abbott

You Can Make Real Cash Quick this Easy Fascinating Way

TENOR BANJO

Above are only three out of hundreds who have made more money and friends through my amazingly rapid method of learning the Tenor Banjo. [illegible] a note or learned a string before—but I have made them [illegible] musically and financially. Now I am ready to do the same for YOU!—Learn!

Have Friends, Fun and EXTRA MONEY

[illegible]

FREE Book Tells How

This book explains how YOU can make more friends, [illegible] EXTRA CASH easily. Get [illegible] of music. Mail coupon NOW!

Now Only $20 for TENOR BANJO and Phonograph Records Come with 1st Lesson

Let us send you this handsome [illegible] Tenor Banjo. Complete [illegible] Instruction Phonograph Records, Gold Disc Chart, Lessons everything you need WITHOUT ONE CENT EXTRA COST. No long, tedious "scales" Learn quick, learn right! Get the FACTS in the Free Book the coupon brings!

Clip and Send

A. C. Black, Pres.
New York Academy of Music
Studio 1151, 100 Fifth Ave. New York

Please send me FREE Book on Tenor Banjo Success. The Play-Way to Popularity and Big Pay.

Name .....

Address .....

1000 NEEDED INVENTIONS

Here is the most remarkable book ever offered to the public. One Thousand needed inventions listed and described. Arranged as follows: General, Problems, Automotive, Mechanical, Electrical, Chemical, Radio, Marine. Separate chapter on the Ten Most Needed Inventions. The book may give you new ideas that will win you a fortune. Nothing else like it has ever been published. Compiled at enormous expense. Edited by Raymond Francis Yates, formerly Managing Editor of a leading scientific magazine. Over 100 pages, durably bound. Price $1.25.

Send No Money

Cut out this advertisement now and send it to us with your name and address plainly written and your copy of this remarkable book will be sent immediately. Pay the postman only $1.25 plus postage on arrival. Money back after 10 days examination if desired. [illegible] edition. Write NOW. (Foreign orders $1.45 cash with order.)

BUREAU OF INVENTIVE SCIENCE
Dept. 212 Rochester, New York

INVENTORS

[illegible] details of your invention or write for information. [illegible] patents 20 years. Complete booklet. Randerson, Adam Fisher Mfg. Co. 188-D Enright, St. Louis, Mo.

A definite program for getting ahead financially will be found on page four of this issue.

Killing Fires in the Air

(Continued from page 160)

effective radius five times greater than the ordinary sprinkler. It may also be controlled by valves located in a fireproof box near the front door of the building.

On one occasion the second floor of a bonded warehouse on Mercer Street was ablaze, and the sprinkler automatically sent in the alarm and started off on its whirl of duty. On arriving at the fire, Deputy Chief (Smoky Joe) Martin found that large supplies of naphtha and industrial alcohol were stored on the fourth floor. To protect these, Chief Martin merely opened the valves controlling the third and fourth floor sprinklers. Thus "damped down" both floors and effectually prevented the upward progress of the flames.

Children of the slums have reason to remember John Kenlon gratefully for the cooling showers that descend from the patented "Kenlon nozzle," a hydrant attachment invented by the fire chief when public baths were rare. When the Kenlon nozzle is attached to a hydrant, that hydrant immediately becomes a cool oasis amid sweltering city streets, sprinkling hundreds of children with streams of fresh water. It is widely used in the poorer sections of New York where thousands of city bound kiddies eagerly await the midsummer relief of the chief's shower.

AT THE age of sixty-eight, Chief Kenlon is just as dynamically progressive as he was at forty. Only recently he returned from a congress of European Fire Chiefs at Turin, Italy, where he made an intensive study of modern fire-fighting devices, and gave lectures on the special problems of the metropolitan fire department. Present indications point to another ten years of service, and it will surprise no one who knows him if he is still commanding his fire-fighting army at eighty.

One thing is self-evident during the seventeen years that Kenlon has been chief of the Fire Department, New York City has had no great conflagration. Despite the crowded population and the fire problems of the first magnitude, he has nipped every blaze before it could really get started. Nothing has got away from him yet. Jack Kenlon would be the first to admit that his city has been guarded by a special Fire Providence—but there are plenty of others, including his 6,000 officers and men, who think that the greatest blessing of that Fire Providence is Fighting Jack Kenlon.

Begin It Next Month

The most thrilling story of its kind ever written—the complete, inside story of

The Wright Brothers
FATHERS OF FLIGHT

Revealing absorbing anecdotes, adventures, and dramatic episodes in the birth of the airplane

Never Before Published

A wealth of fascinating new facts gleaned from the private papers and conversations of Orville Wright

You won't want to miss it. Better tell your news dealer to reserve your copy of the January issue now

PATENTS

TRADE-MARKS ✦ DESIGNS
FOREIGN PATENTS

MUNN & CO.

PATENT ATTORNEYS

Associated since 1846 with the Scientific American

Scientific American Building
24 W. 40th St., *New York City*

Scientific American Building
Washington, D. C.

Tower Building
Chicago, Ill.

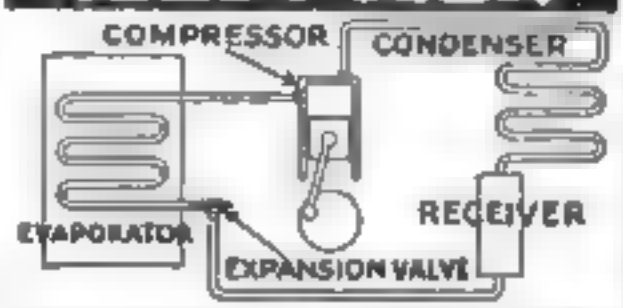
Van Nuys Building
Los Angeles, Cal.

Hobart Building
San Francisco, Cal.

Books and Information on Patents and Trade-Marks by Request

Associates in all Foreign Countries

NEW INDUSTRY NEEDS MEN



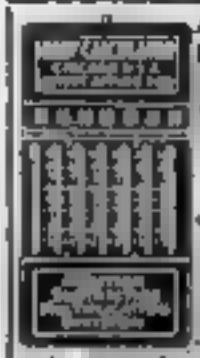
ELECTRIC REFRIGERATION Calls You

Natural American laborer made men for $200 to $1,000 a month jobs in production, service installation and sales. Fastest growing money making field backed by General Motors. General Electric etc. Now may become training qualifies you for big pay job. This training is endorsed by Servel, Kelvinator and other large manufacturers.

FREE BOOK

"Opportunities in Electric Refrigeration" reveals amazing plan to assist you to get. Sent free. No obligation. Be the first in your neighborhood to get into this new magic industry. Write today. Utilities Engineering Institute, Dept. 213, 3130 N. Clark St., Chicago, Ill.

ADDING MACHINE VEST POCKET SIZE



ADDS, SUBTRACTS, MULTIPLIES, DIVIDES

FREE TRIAL SEND NO MONEY

$2.50 TRIAL COST

Mail Coupon Today

BART CALCULATOR SALES CO., MANUFACTURERS
Dept. 81, P. O. Box 3113, CHICAGO, ILL., U. S. A.

[ ] I am enclosing $2.50—send adding machine prepaid
[ ] Send adding machine C. O. D. $2.50 plus postage.

Name
Address
City State

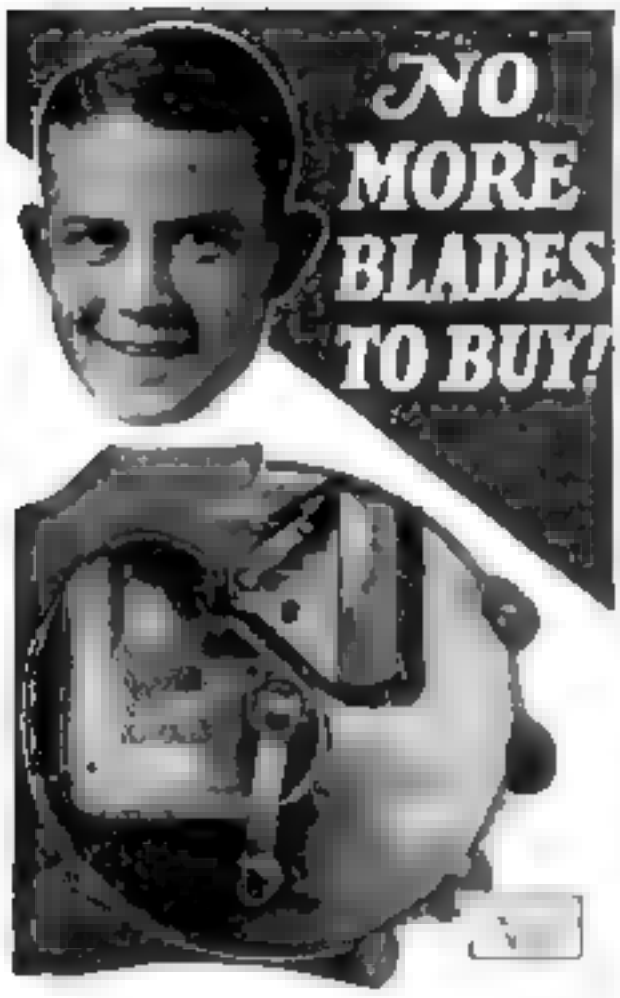
AGENTS Write for big commission and exclusive territory proposition.

INVENTORS PROTECT YOUR IDEAS

Send for our Guide Book, **HOW TO GET YOUR PATENT**, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for **Inspection and Instructions Free. Terms Reasonable. Best References.**

RANDOLPH & CO.
Dept. 130, Washington, D. C.

Name
Street
City State



Amazing Invention Revolutionizes Shaving!

THINK of it! 365 keen, cool shaves a year from the same razor blade. That's what KRISS-KROSS is doing for hundreds of men—can do for you.

This amazing new invention marks a radical advance in shaving comfort and economy that deserves to be called much more than a stropper. Rather it is a blade rejuvenator. Makes hundreds of keen, quick shaves blossom where only one grew before.

KRISS-KROSS strops your blade (any make) on the diagonal just like a master barber. Pressure determines automatically. Nicks go flying up to dry gray when your blade is ready with the keenest cutting edge that steel can take!

Special Free Offer

To introduce KRISS-KROSS I am giving with it Free a new kind of razor. Possesses remarkable features. Instant adjustable for any shaving pressure. A flip of the finger makes it a T-shape for right or left-hand style. Use diagonal new way. Gives a shearing instead of pulling cut. The Bevel Edge wipes right through the toughest crop of whiskers and leaves your face as smooth and cool. Made of stainless steel. Comes with 5 special process blades and is entirely unlike anything you ever saw before!

Get Details

Send for details on these astounding investment and free razor offer. There is much more remarkable than I can tell you here. Clip the coupon now. No obligation. Mail it today.

AGENTS! Make big money as a KRISS-KROSS representative. J. C. Feiberg made $300 in 7 days. He has earned $60 in one day. Just a few weeks with KRISS-KROSS for friends. Check bottom of coupon and mail at once!

Rhodes **KRISS KROSS**

RHODES MFG. CO. STROPPER

Largest Manufacturer of Mechanical Strappers in the World

Dept. W-243, 1418 Pendleton Ave., St. Louis, Mo.

RHODES MFG. CO
Dept. W-243, 1418 Pendleton Ave., St. Louis, Mo.

Please send me without obligation, details of KRISS-KROSS stropper and FREE razor offer

Name

Address

City State

☐ Check here if interested in becoming representative.

The Last of the Vikings

(Continued from page 56)

sowing into the snow in the lee of a low mound. The weather moderated and snow became slush as he slept. Then a drop in the temperature crystallized the slush. Amundsen was encased, as he afterwards expressed it, in a ghastly coffin of ice. Fortunately his companion had chosen to sleep exposed and was able to free him after hours of torturous work. Amundsen always afterward dignified that adventure as one involving as many hardships as anything he experienced on his polar expeditions.

Army training over, he signed as a sailor aboard a ship of the sealing fleet, worked up to the position of mate, and prepared for examination for a skipper's license. His reading about Arctic exploration had convinced him that many expeditions failed because the organizations divided into hostile groups, one of scientists and one of sailors. Amundsen determined that he would be the real leader of his expeditions. He would be the explorer and the ship's navigator as well.

WHEN he was twenty-five, in 1897, he was accepted as a member of the Belgian Antarctic expedition to study the South Magnetic Pole. Before the expedition left Europe he was made first mate. The captain was a Belgian artillery officer who had been also in the French Navy. The physician of the expedition was the same Dr. Frederick Cook whose assertion, long afterward, that he had discovered the North Pole threw scientists into a controversy that never has ended. Amundsen, unrelentingly, never lost faith in Cook, whom he knew to be an exceptionally capable leader, and a man who understood the Arctic as well as he did himself. During his last lecture tour in the United States Amundsen visited Dr. Cook in the Federal Penitentiary at Leavenworth, Kansas, where he comforted, as best he could, his former companion confined there as a swindler.

The *Belgica*, as the expedition ship was called, reached the Strait of Magellan in the winter of 1897, then proceeded southward until, by mischance and bad judgment of the commander, the small ship was caught in the grip of an ice field. For thirteen months the ill-equipped company were prisoners. Icy gales bit through thin garments. Some of the men went insane. Scurvy afflicted all but three and of those, one was Amundsen and the other was Cook.

DR. COOK knew that the fresh meat and blubber of seals and penguins contained an antidote that would guard them all from the shrunken gums and emaciation of scurvy. The word vitamin was then unknown, but the physician knew that there was some kind of magic for the body chemistry of mankind in fresh meat and fresh vegetables. But a stark notion of the captain of the expedition prevented the others from eating the slaughtered animals that lay in frozen mounds on the ice close to the ship. Cook and Amundsen had hunted and killed the creatures until there were plenty for all, but not until the leader became so ill that he surrendered the command to Amundsen, was the party permitted to eat them.

It was Cook who then attacked the problem of getting the ship out of the ice. Under the new leadership the men were clad in suits fashioned by a sail maker out of bright red blankets. Clad in these improvised costumes the emaciated men went to work with the only available saw—much too short—and some sticks of explosive, tonite, cutting what they hoped might provide a channel to the open sea. After weary weeks the channel opened and the ship emerged. Again it was caught between two mountainous bergs and was ground as between millstones for a frightful twenty-four hours. Again, according to Amundsen's

(Continued on page 165)

FIT yourself for a big job in electricity by knowing electrical practice complete, including inside and outside work, central stations, and the whole subject. With the aid of the Croft books you can know electricity as experts know it and put yourself in line for an expert's pay.

The Croft Library of Practical Electricity

A reference library and self-training course in eight volumes. 3000 pages —1000 illustrations

In these volumes Croft teaches you electrical practice complete. He takes you in quick, easy steps from the most elementary principles to the most complex and technical operation of power and railway stations. He explains everything as he has learned it in his years of actual practice.

What these books can do for you. How you can learn as much about electricity in six months—more practical "meat and butter" stuff—as he would ordinarily learn in a lifetime of practice. 50,000 sets now in use.

Send no money—
—just mail the coupon

FREE EXAMINATION COUPON

McGRAW-HILL BOOK CO., Inc., 370 Seventh Ave., New York

Send me Croft's Library of Practical Electricity, 8 volumes. If not satisfactory I will return books in 10 days. Otherwise I will remit $2 in 10 days and $3 monthly thereafter until $24 has been paid. (Foreign price $28 cash with order.)

Signed

Address

City and State

Position

Reference

P.S. 12-28

LAW STUDY AT HOME

We guide you step by step. You train at home during spare time. Degree of LL.B. conferred. Legally trained men win high positions and big success in business and public life. Greater opportunities now than ever before. Big corporations are headed by men with legal training. Many lawyers are members of our faculty and constant consultants. Low cost, easy terms. Get our valuable 64-page "Law Training for Leadership" and "Evidence" books FREE. Send for them NOW.

LaSalle Extension University, Dept. 1293-L, Chicago
The World's Largest Business Training Institution

Wrestling Book FREE

Learn to be an expert wrestler. Know scientific wrestling and defense and the Jiujitsu. Develop physique and have perfect health. Join the popular sport and learn by mail. Free illustrated book tells secrets of champions—the marvelous

Frank Gotch and Farmer Burns

System. Write for free book today stating your age.

Farmer Burns School of Wrestling, 1200 Range Bldg., Omaha, Neb.

"STAMMERING Its Cause and Cure"

You can be quickly cured if you stammer. Send 10 cents only for 284-page illustrated book on Stammering and Stuttering. It tells how I cured myself after stammering and stuttering for 20 years.

BENJAMIN N. BOGUE
1365 Bogue Bldg., 1147 N. Illinois St., Indianapolis

MOVIES In Your Home

Own your own Movie Machines. Big profits. Small investment. We sell on easy terms. Big line of 16 mm. and 35 mm. machines with a new 16 mm. sensational picture. Write us today for free catalog and special offer.

Don't Miss This!
Write Us Today For Free Catalog and Special Offer
PARAMOUNT MANUFACTURING CO.
Dept. 1271-K, Boston, Mass.

The Last of the Vikings

(Continued from page 160)

recollections, the company of mariners owed their existence to Cook. He had encouraged them to save the skins of the slaughtered penguins and seals, and these were used as mats to cushion the sides of the ship against the icy jaws.

Two years after his departure Amundsen was back in Europe, determined to become the leader of his own expedition. He sought out Fridtjof Nansen, after getting his skipper's license, and through Nansen received introductions to other scientists who aided him in his enterprise.

He went to Hamburg, Germany, and saw Geheimrath George von Neumayer, to whom he explained that he wished to learn how to take magnetic observations. The benign old man embraced his young caller when he learned that Amundsen had determined to attempt the impossible: to find and conquer the Northwest Passage, and, most important, find the true location of the magnetic North Pole.

"YOUNG man," he told Amundsen, "if you do that you will be the benefactor of mankind for ages to come. That is the great adventure."

Returning to Norway, Amundsen bought a fishing smack. It was an old boat of forty-seven tons—seventy-two feet long, eleven feet wide, and of shallow draft. He named her the *Gjoa*. Today that weatherworn old craft is a treasure of the people of San Francisco, presented to them by Amundsen when he came triumphant down the west coast after accomplishing the dream that had troubled explorers for more than four centuries.

That little sloop of Tromsö had adventures that were never contemplated by her honest builders. She had only one mast and could fly but one mainsail and a couple of jibs. There was a good auxiliary motor. So much cargo was crammed into the hold and stowed on deck, that afterwards the explorer recalled that she looked like a moving van as her lines were cast off and she sailed into the unknown.

Amundsen found the magnetic pole, relocating it after a lapse of three quarters of a century. During the long months the needle of the *Gjoa*'s compass remained, according to Amundsen, "as fixed as a stick."

HE HAD taken slabs of marble on which to mount the instruments with which he made his observations. These were laid on a rock foundation. This was no dash to the pole. It was a long, long wait amid conditions as bleak as the face of the moon. [illegible] the party built their observatories, fashioned kennels for their dogs, and provided themselves with a snug house. When that was done they concerned themselves with a supply of fresh meat, and it was then that Amundsen had one of his greatest thrills.

They had supposed they were far removed from any other human beings. They were accustomed to set out in parties of two, hunting caribou. Before long they had piled up a mound of a hundred carcasses which were preserved by the natural refrigeration of the region. Then one day, Amundsen and two of his companions were standing on the deck of the *Gjoa* when one of them exclaimed:

"There is a caribou!"

He pointed to a small black object against the skyline. But it was not a caribou, as they discovered when the other man announced bluntly, "That caribou walks on two legs."

In great excitement they watched the creature moving in their direction. Presently they saw five figures marching unmistakably toward the tiny ship. Amundsen sent his companions for their rifles and then the three advanced to meet the strangers, dark-skinned men who they now could see were armed.

The two groups (Continued on page 164)

They Laughed When I Sat Down At the Piano But When I Started to Play!—

"Can he really play?" I heard a girl whisper to Arthur, as I sat down at the piano.

"Heavens, no," Arthur exclaimed. "He never played a note in all his life."

Then I gave them the surprise of their lives. I started to play. Instantly a tense silence fell on the guests. I played the first few bars of Liszt's immortal Liebestraum. I heard gasps of amazement. My friends sat breathless—spellbound. I played on.

A Complete Triumph!

As the last notes of the Liebestraum died away, the room resounded with a sudden roar of applause. Everybody was piling me with questions. "Jack! Why didn't you tell us you could play like that?" "Where did you learn?" "Who was your teacher?"

Then I told them the whole story.

"It seems just a short while ago that I saw an ad of the U. S. School of Music telling a new method of learning to play which only averages a few cents a day! Without a teacher! And no 'skill-test' scales or exercises! I sent for the Free Demonstration Lesson and was amazed to see how easy it was to play this new way. I sent for the course and found it as easy as A B C! Before I knew it I was playing all the pieces I liked best. I would soon be able to play ballads or jazz with equal ease. And I never did have any special talent for music!

LEARN TO PLAY BY NOTE

Play Any One!

Mandolin	Saxophone
Piano	'Cello
Organ	Ukulele
Violin	Cornet
Banjo	Trombone

or any other instrument

Play Any Instrument

You, too, can now learn music—right at home—in half the usual time. You can go wrong with this simple new method which has already shown almost half a million people how to play their favorite instruments by note. Just read the list of instruments in the panel, decide which one you want to play and the U. S. School will do the rest.

Free Demonstration Lesson

Thousands of successful students never dreamed they possessed musical ability until it was revealed to them by a remarkable Musical Ability Test which we send entirely without cost with our interesting free booklet and Free Demonstration Lesson.

Mail coupon now before you forget. Instruments supplied when needed, cash or credit. U. S. School of Music, 913 Brunswick Bldg., N. Y. C.

U. S. School of Music,
913 Brunswick Bldg., New York City

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane, Free Demonstration Lesson and particulars of your easy payment plan. I am interested in the following course:

Have You Instr?

Name

Address

City State

AGENTS 500% PROFIT
GENUINE GOLD LEAF LETTERS

Guaranteed to never tarnish. Anyone can put them on stores and office windows. Enormous demand, large profits. Paul Clark says smallest day $28.70. H. L. Reel made $90 in two months. Write today for free sample and liberal offer to general agents.

METALLIC LETTER CO., 428 N. Clark Street, Chicago.

Col. Lindbergh visits "Bud" Gurney, his successor as our Chief Air Mail Pilot and Instructor. Read illustrated story in new book: "MAKING GOOD IN AVIATION." Price, 25c.

Making Good in Aviation

Get this vitally interesting new book—full of valuable suggestions—your opportunities in aviation—your first step—how pilots and mechanics are trained for big paying positions.

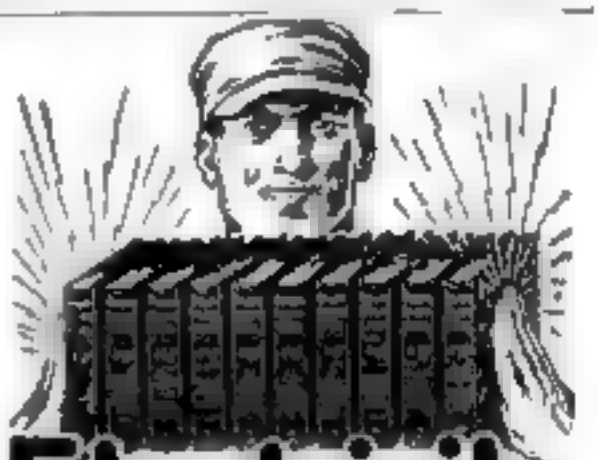
Read the thrilling story of the days when Col. Lindbergh flew the mails—how "Bud" Gurney rose from barnstormer to Chief Air Mail Pilot.

"MAKING GOOD IN AVIATION"—containing full page photo of Col. Lindbergh and other interesting illustrations—sent postpaid for 25c, stamps or coin.

Air Mail Pilots Teach Flying

to advanced students at Robertson School of Aviation—an exclusive feature of this institution, one of the oldest, largest best equipped schools in the country. Over 9½ years—250 graduates—no accidents. Army School system. Ten Licensed Transport Pilots on teaching staff. Modern training ships. "Ryan" and "Curtiss Robin" factories on field. Write today. Dept. Q.

ROBERTSON FLYING SERVICES, Inc.
Affiliated with Robertson Aircraft Corporation
Lambert-St. Louis Flying Field
Anglum, St. Louis County, Mo. 25810



Electricity at your finger ends

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity.

Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes.

Books are pocket size; flexible covers. Order a set to-day to look over.

HAWKINS GUIDES

1500 PAGES 4700 PICTURES — $1 A VOLUME $1 A MONTH

These books tell you all about—

Magnetism—Induction—Experiments—Dynamos—Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamos—Electrical Instrument Testing—Practical Management of Dynamos and Motors—Distribution Systems—Wiring—Wiring Diagrams—Sign Flashers—Storage Batteries—Principles of Alternating Currents and Alternators—Alternating Current Motors—Transformers—Converters—Rectifiers—Alternating Current Systems—Circuit Breakers—Measuring Instruments—Switch Boards—Wiring—Power Stations—Insulating—Telephone—Telegraph—Wireless—Bells—Lighting—Railways—Aeroplane—Modern Practical Applications of Electricity and Ready Reference Index.

SHIPPED TO YOU FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send coupon now—today—and get this great help library and see it. It is not worth $10 to you—pay $1.00 a month for ten months or return it.

SEND NO MONEY

THEO. AUDEL & CO.
65 W. 23rd St., N. Y.

Please submit for examination Hawkins Electrical Guides (Price $1 each). Ship at once, prepaid, the 10 numbers. If not satisfactory I will agree to send you $1 within seven days and to further mail you $1 each month until paid.

Name

Address

Occupation

Employed by

Just Out!

the very latest and never before disclosed Secrets of

Magic

Be a Magician

Write for Free Magic Book!

New! Different! Dr Harlan Tarbell, Famous Magic Wizard, teaches you Big New Tricks, Illusions, Stage Stunts, "Patter" and the Principles of Magic. You get *new — and never before disclosed* — Secrets of Magic. You learn easily and quickly at home by mail. Write today for big *free* Magic Book.

Earn $250 to $1000 a Month

Magic is Now made simple to learn For Dr Harlan Tarbell, one of the really Great Magicians, has finally opened up the secrets of his profession in a completely illustrated course offered at a merely nominal cost. You will be able to mystify and entertain your friends with simple tricks taught in your very first lesson Dr Harlan Tarbell takes you through the entire maze of sleight-of-hand, card tricks and elaborate stage divertisements. The apparently superhuman doings of the accomplished magician become as simple as ABC when you just know how

Magic Book—FREE!

Write! Mail coupon now for big free Magic book telling all about the great Tarbell Course in Magic. *Get Our Low Prices and Easy Payment Plan.*

Tarbell System, Inc., Studio 5-D
1930 Sunnyside Avenue, Chicago, Ill.

Gentlemen: Without any obligation send me your free literature and information all about your wonderful "Tarbell Course in Magic." Also tell me about your Low Prices and Easy Payment Plan.

Name .....

Address .....

..... Age .....

The Last of the Vikings

(Continued from page 163)

approached each other until they were separated by only fifteen paces, when they halted.

Turning to his followers, Amundsen instructed them to throw their rifles down. This pacific pantomime had the hoped-for result. The leader of the other group turned to his men and spoke sharply. They, too, threw down their bows and arrows.

Amundsen stepped forward, and the Eskimo leader did likewise. Then began a curious conversation of nods, gestures, exaggeratedly friendly smiles, soothing tones. Just as Robinson Crusoe succeeded by signs in communicating with the frightened cannibal who became his man Friday, so did Amundsen succeed in talking with these primitive hunters who never before had seen a white man.

From that moment there began an association with the Eskimo tribe that endured until Amundsen sailed away two years later

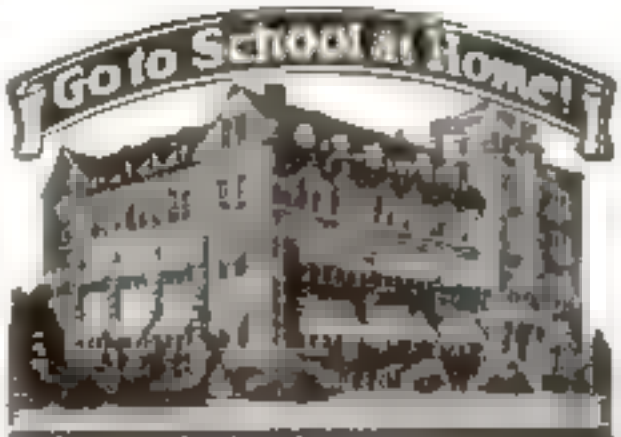
"THIS was a truly thrilling moment in the lives of these savages," Amundsen has recorded in *My Life As An Explorer*. No one of them had ever seen a white man before, yet white men were a part of a legendary tradition of their tribe. Seventy-two years earlier, their grandfathers had met Sir James Clark Ross on almost this very ground

Amundsen made his visitors welcome aboard his ship and after they had been treated to the usual evidences of hospitality the Eskimos asked by signs if they might bring their tribe and settle down beside the ship. They came, built their ice houses, traded some of their finest possessions, gorgeous fur clothing, primitive weapons and other things to delight the heart of ethnologists, in exchange for things Amundsen had brought for the purpose of trading with any natives he might encounter He found his Eskimo friends were totally inexperienced in the use of metal, but they were quick to appreciate its value. A heavy steel needle was the price he paid for a quartet of white fox skins, the finest he had ever seen. For an empty tin he was given two complete sets of women's clothing. This trading continued until the Eskimo tribe had been enriched beyond their wildest dreams by the possession of steel knives, other steel tools, strings of glass beads that were to the primitive people like the finest of jewels. And when Amundsen sailed away, the hull of the *Gjoa* was crowded with a complete collection of the artifacts of that strange race with which he had dwelt. Today those trophies are the chief treasures of a Norwegian museum.

IT WAS after leaving the Eskimos that Amundsen found the Northwest Passage. Week after week the little *Gjoa* was pressed westward by icy winds. At times the boat was in a channel no more than a quarter of a mile wide between the shore and the ice pack. Then one day the helmsman sped ships on the western horizon. It was a whaling fleet, and Amundsen had his first great taste of triumph. The whalers were Pacific Coast ships and the Norwegian explorer knew that he had navigated his little craft through the most difficult part of its voyage. He had found the Northwest Passage.

The *Gjoa* and her company settled down there on the Northern fringe of the American continent at Herschel Island to wait for spring. That was during the long Arctic night. Most of the whaling fleet men were content also to await the coming of spring, but there was one captain whose ship had been pushed by the ice far up on the beach. He was eager to return to San Francisco so that he could outfit another vessel, and Amundsen wished to send out word of his own success. Together they started on foot to the most northerly outpost of the American Army, Fort Egbert, in Alaska, 500 miles away, on the

(Continued on page 165)



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements of* a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

American School
Dept. H-975,
Drexel Ave. and 58th St., Chicago

American School
Dept H-975, Drexel Ave. & 58th St., Chicago

Send me full information on the subject checked and how you will help me win success.

Architect	Business Law
Building Contractor	Lawyer
Automobile Engineer	Machine Shop Practice
Automobile Repairman	Mechanical Engineer
Civil Engineer	Shop Superintendent
Structural Engineer	Employment Manager
Business Manager	Steam Engineer
Cost Public Accountant	Foremanship
Accountant and Auditor	Sanitary Engineer
Bookkeeper	Surveyor (& Mapping)
Draftsman's and Designer	Telephone Engineer
Electrical Engineer	Telegraph Engineer
Electric Light & Power	High School Graduate
General Education	Wireless Radio
Vocational Guidance	Undecided

Name .....

Address .....


This one
R7GX-NOL-QR5T

The Last of the Vikings

(Continued from page 164)

far side of a range of mountains 9,000 feet high.

They had two sledges and twelve dogs hired from an Eskimo named Jim, who accompanied them. They made twenty-five to thirty miles a day through the snow, Jim running ahead of one sledge and Amundsen ahead of the other. But the whaling captain did not run, nor walk either. He rode, a short fat tyrant who criticised Amundsen for not making better time.

When they arrived at Fort Egbert, on December 5, 1905, the thermometer registered sixty degrees below zero. The Army officer in command gave Amundsen a great welcome and arranged for the dispatch of his account of his adventures. After receiving telegraphic congratulations from America and Europe, Amundsen started back over the long, blind trail of 500 miles through ice and snow. The end of the long adventure came when Amundsen and his six companions navigated the *Gjoa* through the Golden Gate and were received in triumph by the people of San Francisco.

AFTER his return to Norway Amundsen at once prepared for another Arctic expedition, this time to see the North Pole. His plans were interrupted, however, by a bearded man who came out of the Arctic with the startling news that he had discovered the North Pole. His name was Robert Peary.

The news of Admiral Peary's success was a blow to Amundsen's aspirations. Finding the North Pole was to have been the great act of his life. Nevertheless he went ahead with his preparations to enter the Arctic, letting the world and even the crew of his ship (the *Fram*, in which Fritjof Nansen had carried on his Arctic explorations) believe that his enterprise was to be an attempt to drift on the polar currents across the Arctic sea from America to Europe. The vessel was well down the Atlantic before the crew were informed of his true purpose. When he broke the news they were delighted. What he told them was that he had determined to try to reach the South Pole!

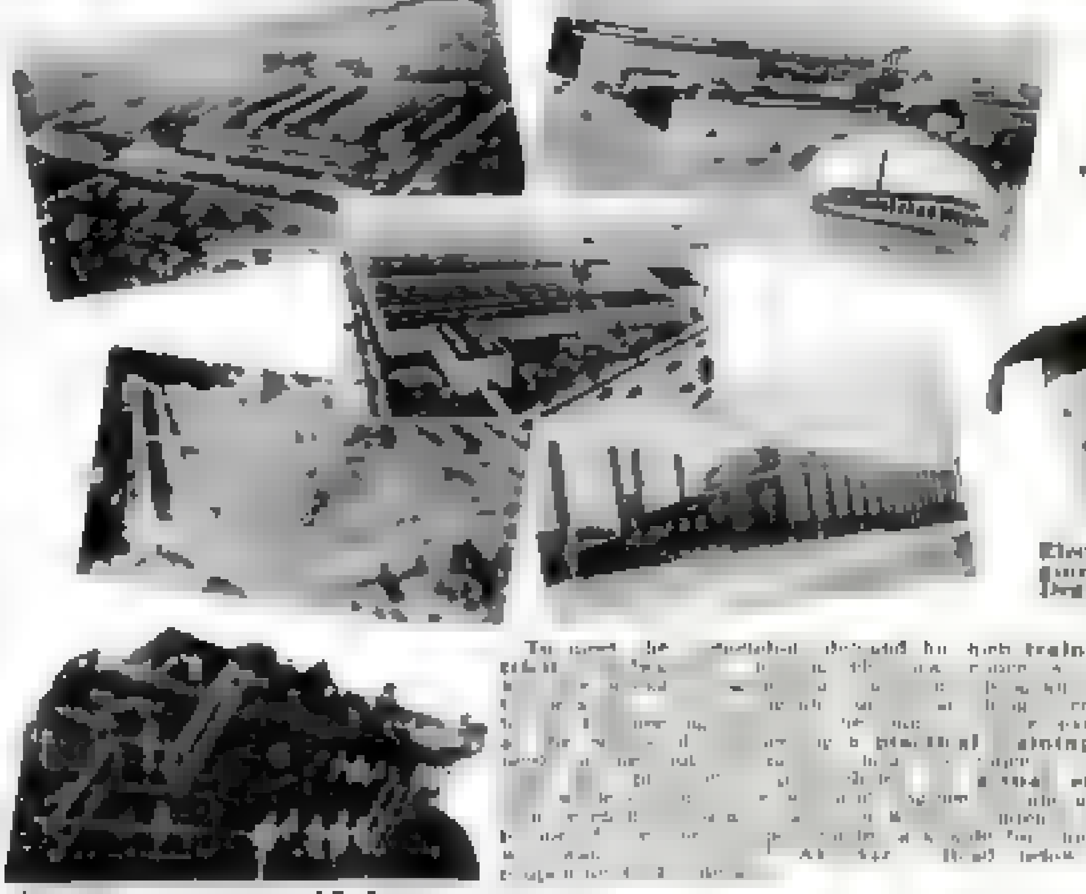
On that historic voyage which culminated in the discovery of the South Pole, Amundsen took Eskimo dogs from Greenland, more than a hundred of them, kept on the deck and even the bridge of the small *Fram*. At the Bay of Whales, an ice harbor in the Antarctic glacier, he set up a staunchly built house, trained his dogs, stored up food reserves of slaughtered seals and penguins to supplement the tons of pemmican he had brought in the hold of the *Fram*, and gradually established a line of depots ever nearer to the South Pole. Months of labor were consumed in rebuilding his dog sledges, until they weighed only about a third as much as they had originally.

HUNDREDS of pounds of food were left in the line of caches that were established ever nearer and nearer to the pole. Extending out east and west from those caches were bamboo poles to which were tied bits of bunting. Amundsen was taking as little chance as possible of losing his way. Each of those traverses extended about nine miles, so that when all was in readiness and the great trip was begun the biggest part of the journey from the Bay of Whales was marked like a boulevard, with bamboo flag poles, wooden stakes, and even dried fish. Included in his calculations was the flesh of the dogs themselves.

As an instance of care with which Amundsen protected his party from hunger, before the winter set in on the edge of the ice barrier he and his men had shot sixty tons of seals and stored the meat. Through the Antarctic winter the preparations proceeded sometimes in a temperature of seventy-four degrees below zero. At last, in October, 1911, Amundsen was ready for his great attempt.

For the dash, his party consisted of five men, four sledges, and (Continued on page 168)

Great Industrial Concerns Unite With School of Engineering!



Electrical Engineering B.S. Degree in 3 years

U. S. Govt. requests S. of E. Students to assist in acceptance tests of 3 Diesel Engines for Panama Canal.

Men Wanted

For Commercial Electrical Engineering

Earn While You Learn

FREE BOOK

SCHOOL OF ENGINEERING

Dept. P.S.M. 1228, Milwaukee, Wis.

Radio and Electrical Refrigeration

School of Engineering, Dept. P.S.M. 1228, Milwaukee, Wis.

Name Age

Address

Education

MAKE BIG MONEY

Results Quick - Part or Full Time.

NATIONAL POULTRY INSTITUTE

Washington, D. C.

Learn Cartooning

THE LANDON SCHOOL

Cleveland, O.

Play the Hawaiian Guitar like the Hawaiians!

Easy Lessons

GIVEN when you enroll

HAWAIIAN GUITAR, Carrying Case and Playing Outfit

FIRST HAWAIIAN CONSERVATORY of MUSIC, Inc.

New York, N. Y.

"The Boss Was Stumped"

"He was trying to figure out a way to speed up the machines. I could see he was stumped and I asked him if he would let me try my hand at it.

"'Go ahead,' he said, 'but I don't believe you can help much. Looks like an outside job to me.'

"So I started right in and pretty soon I had the whole thing worked out. The boss was watching me and I could see he was surprised.

"'How did you learn that?' he asked in that quiet way of his. And then I told him I'd been studying at home nights with the I. C. S.

"He didn't say anything and I thought he had forgotten about it until he called me in his office a few weeks later. He said he was going to make me foreman and increase my salary $5 a month.

"'Keep on studying,' he told me, 'and you'll get another promotion soon.' You can't beat those I. C. S. textbooks for good, sound practical knowledge."

That's a true story of what spare-time study has done for just one man. There are thousands of others. Why don't you take up a home-study course with the International Correspondence Schools and prepare yourself to earn more money?

Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 7466-F Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet "Who Wins and Why" and full particulars about the subject before which I have marked X.

BUSINESS TRAINING COURSES

- Business Management
- Industrial Management
- Personnel Management
- Traffic Management
- Accounting and C. P. A. Coaching
- Cost Accounting
- Bookkeeping
- Secretarial Work
- Spanish [illegible] French
- Salesmanship
- Advertising
- Better Letters
- Business Correspondence
- Stenography and Typing
- Civil Service
- Railway Mail Clerk
- Common School Subjects
- High School Subjects
- Illustrating
- Cartooning

TECHNICAL AND INDUSTRIAL COURSES

- Electrical Engineer
- Electric Lighting
- Mechanical Engineer
- Mechanical Drafting
- Machine Shop Practice
- Railroad Positions
- Gas Engine Operating
- Civil Engineer
- Surveying and Mapping
- Plumbing and Heating
- Steam Engineering
- Radio
- Architect
- Architects' Blueprints
- Contractor and Builder
- Architectural Drafting
- Concrete Builder
- Structural Engineer
- Chemistry
- Pharmacy
- Automobile Work
- Airplane Engines
- Agriculture and Poultry
- Mathematics

Name.

Street Address

City State

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada.

DRAW CARTOONS

Turn Your Talent Into Money

Cartoonists earn from $50 to $1,000 per week. Many more have made big money in spare time. Here's a new, simple way to learn Cartooning. Send for Booklet and sample lesson plate explaining full details of the Course. No salesman will call.

THE NATIONAL SCHOOL OF CARTOONING
818 Perkins Building Cleveland, Ohio

Pathfinder

TO ALL
13 WEEKS
$1 A YEAR 15 CENTS

Tells the truth about the Nation's Capital. Bright, interesting, dependable. Different. Covers the Washington scene as it is. Tells what's going on behind the scenes. Explains the why of the day's news. Pictures and cartoons. Special articles by famous writers. Tells what's going on in Congress. Tells what's going on in the Executive Departments. Tells what's going on in the Courts. Tells what's going on in the World of Science. Tells what's going on in the World of Art. Tells what's going on in the World of Literature. Tells what's going on in the World of Music. Tells what's going on in the World of Drama. Tells what's going on in the World of Sports. Tells what's going on in the World of Society. Tells what's going on in the World of Business. Tells what's going on in the World of Finance. Tells what's going on in the World of Industry. Tells what's going on in the World of Agriculture. Tells what's going on in the World of Labor. Tells what's going on in the World of Politics. Tells what's going on in the World of Religion. Tells what's going on in the World of Education. Tells what's going on in the World of Science. Tells what's going on in the World of Art. Tells what's going on in the World of Literature. Tells what's going on in the World of Music. Tells what's going on in the World of Drama. Tells what's going on in the World of Sports. Tells what's going on in the World of Society. Tells what's going on in the World of Business. Tells what's going on in the World of Finance. Tells what's going on in the World of Industry. Tells what's going on in the World of Agriculture. Tells what's going on in the World of Labor. Tells what's going on in the World of Politics. Tells what's going on in the World of Religion. Tells what's going on in the World of Education.

Your neighbors know the Pathfinder and you will like it—the every-week digest from the Nation's Center. Bright, interesting, dependable, different, covering also the Washington scene as it is. Tells what's going on behind the scenes. Explains the why of the day's news. Pictures and cartoons. Special articles by famous writers. Tells what's going on in Congress. Tells what's going on in the Executive Departments. Tells what's going on in the Courts. Tells what's going on in the World of Science. Tells what's going on in the World of Art. Tells what's going on in the World of Literature. Tells what's going on in the World of Music. Tells what's going on in the World of Drama. Tells what's going on in the World of Sports. Tells what's going on in the World of Society. Tells what's going on in the World of Business. Tells what's going on in the World of Finance. Tells what's going on in the World of Industry. Tells what's going on in the World of Agriculture. Tells what's going on in the World of Labor. Tells what's going on in the World of Politics. Tells what's going on in the World of Religion. Tells what's going on in the World of Education.

Pathfinder Dept. 26 Washington, D.C.

The Last of the Vikings

(Continued from page 165)

fifty-two dogs. Two months of steady travel southward, over mountains sheathed in ice, across a great plateau, brought them at last to the pole.

"We reckoned," Amundsen wrote afterwards, "that we should be at the pole on December 14. On the afternoon of that day we had brilliant weather—a light wind from the southeast with a temperature of ten degrees below zero. The sledges were going very well. The day passed without any occurrence worth mentioning, and at three o'clock in the afternoon we halted, as according to our reckoning we had reached our goal.

The party assembled about a silken Norwegian flag which they planted in the ice and solemnly gave to that plateau, never before seen by men, the name of "King Haakon VII's Plateau." It was a vast frozen plain stretching in all directions. To make sure that he had actually reached the pole, Amundsen took careful observations of the sun as it circled about their horizon.

By December 16 they had located the exact spot which they had come to find. Under their feet was the core of the earth. All through the day four of them concentrated on the work of observing the sun until at last they were satisfied. Then a circular tent was raised and a Norwegian flag planted above it along with a pennant from the mast of the *Fram*. They gave their camp the name of "Polheim." Then they started back and within a few weeks, because of favorable weather, reached their base. They had started with fifty-two dogs, but they returned with only eleven. The others, as fast as the draft work exhausted them, were slaughtered and used as food for the other dogs. Even the explorers themselves ate dog outlet and liked it.

THREE weeks after Amundsen turned his face from the South Pole, a British naval officer, Captain Scott, reached there with his party, traveling on foot. Scott had taken Shetland ponies and motorized sledges in preference to dogs, and that preference cost him his life. Traveling back to his base after making the disappointing discovery of Amundsen's flag, tent, and records at the pole, Scott and his companions, exhausted by hunger, perished horribly in a blizzard. Afterward, Amundsen expressed the opinion that Scott would have survived if he, too, had taken dogs, which would have provided food as well as transportation.

As a result of his discovery of the South Pole the features of Amundsen became familiar to every school child of every nation. His large and powerful nose, firm mouth, leathery wrinkled skin, snow-white hair, and blue eyes under half closed lids were a symbol for adventure but endless hardships had shriveled some of those supple muscles that once had compelled admiration in the Norwegian army. His tall frame now was gaunt. Young Amundsen had become old Amundsen within a decade.

THERE were other expeditions. Amundsen made a fortune in shipping, and spent it for an enterprise which had as its goal a visit to the North Pole. Associates entrusted with the business management of his affairs became in his eyes untrustworthy. He lost great sums through bad bargains, and at last he was almost penniless in New York. He was, seemingly, just a tired old man sitting under a load of depression in a hotel room—it was the Waldorf—when his telephone rang. A man's voice spoke in his ear; a man named Lincoln Ellsworth, whose admiration for Amundsen was of the same kind which Amundsen had had for Sir John Franklin. Ellsworth had plenty of money, and without wasting words he volunteered to back Amundsen in an attempt to fly to the North Pole.

(Concluded on page 167)

AT HOME!

Let us tell you how you can quickly and easily learn to play your favorite instrument, right in your own home and in your spare time. Music will make you popular, welcomed everywhere, and offer many big money opportunities.

Easy as A-B-C

You need know nothing about music to begin. We give you personal individual instruction right from the start and guarantee you success or refund your money. You will be surprised and delighted that music can be made so easy and fascinating.

Courses in Piano, Violin, Voice, Trumpet, Mandolin, Organ, Banjo, Tenor Banjo, Spanish Guitar, Hawaiian Guitar. Surprisingly low cost, easy terms.

Send for Our New Catalog Today

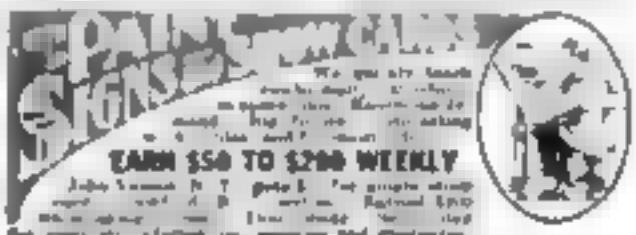
It will tell you all about this great School, now in its 18th successful year, and the wonderful National Academy life and that has meant success to over 100,000 enthusiastic students. Send for it right now, while you think of it. It is FREE.

NATIONAL ACADEMY OF MUSIC
Dept. 142 702 East 41st Street, Chicago

Nationally known mfr. with country wide sales organization, splendid mfg. plant, complete line of metal sales, making [illegible] millions and to enlarge his sales naturally to get workers [illegible] to be paid and the right men a [illegible] Producers and manufacturers especially desired. [illegible] and, big money makers have not already, [illegible] Because of lack of capital sales [illegible] other branches should get in on [illegible] Steps of [illegible] pay no attention [illegible] dress [illegible] Write [illegible] Perry 139 N. [illegible] Ave., Chicago, Ill.

RAISE BELGIAN HARES

MAKE BIG MONEY We Supply Stock
[illegible] Rabbit Ranch Plans [illegible] Send 10c [illegible] 68 page illustrated book, [illegible] and contract. Also one of [illegible] Catalog explains [illegible] Copyrighted Co-operative [illegible] Belgian Hare Breeders Association, Inc. Box 64, Hudson Park, Detroit



DETROIT SCHOOL OF LETTERING
[illegible] Michigan Ave. Est. 1899 Ed. Rice, Mgr.

YMCA TRADE SCHOOL

Learn your Machine, Auto or Electrical Business. We have Shops at Parker St. and Wentworth Ave. Machine Shop, Electrical Shop, Drafting, Welding, Forging, Sheet Metal and Pattern Making. Write for catalog 30.

Branches in Brooklyn, Jersey City, Elizabeth, Paterson, Bridgeport, Hartford, New Haven, Providence, Worcester, Springfield, Boston, Cambridge, Lowell, Lawrence, Lynn, Fall River, New York City.

ILLINOIS COLLEGE of PHOTOGRAPHY

Earn $200 to $400 a month as photographer or picture operator. We prepare you in 3 months. Thorough practical training in making negatives, developing, retouching, printing, lighting, posing, etc. Also in motion picture work. Individual instruction using latest equipment and methods. Graduates assisted. Nation-wide demand. Summer term. Small cost. Free catalog. Box 3126, Effingham, Ill.

BE AN OIL EXPERT

TRAINED MEN NEEDED!

Geologists, Drillers, Refiners, Chemists and Skilled Men, Oil Salesmen, earn from 2 to 10 times more than in other fields. Write today! FREE Booklet!

Petroleum Engineering University
Dept. 451 Fort Wayne, Ind.

The Last of the Vikings

(Continued from page 166)

In May, 1925, they left Spitsbergen in two Dornier flying boats. Six hundred miles on the way to the pole, one of the engines failed, and both planes descended to a bit of open water. It was three weeks before the party returned to civilization in one plane. Meanwhile the world had given them up as lost.

With Ellsworth's backing, Amundsen bought from the Italian government an obsolete semi-rigid dirigible balloon, the *Norge*, and hired as a pilot the engineer who had constructed it. That engineer was Nobile.

The story of the cruise of the *Norge* from Spitsbergen to Teller, Alaska, needs no retelling. However, the comparative ease with which the thing was done, the adulation freely given, apparently went to the head of Nobile. By degrees he assumed for himself a position as leader of the expedition, which certainly he had not been. Nobile toured America making lectures, selling articles, and in other ways skimming the cream from that adventure in a way that was furiously resented by the "old man of the North." Certainly this bitterness spoiled for Amundsen what satisfaction there might have been in the actual sight of the North Pole, previously seen only by Peary and the negro, Matt Henson.

"WHAT would have become of you," Amundsen demanded of Nobile in one savage argument after the completion of that flight, "if the *Norge* had been forced to land on the ice?"

It was in answer to that question that Nobile organized the expedition which culminated in the tragic flight of the *Italia* this year. It ended in disaster, costing the lives of more men than had died on all of Amundsen's expeditions.

But what of Amundsen? He had announced his retirement as an explorer. In books, in interviews, and in lectures he had denounced Nobile; but then, when news came that Nobile was marooned on the ice, he renounced his retirement.

THE huge French hydro-airplane, ordered northward to join in the attempt to rescue the *Italia* explorers, picked up the "old man" at Tromsö. This was not an expedition of his planning. He got into the plane as you might get into a taxicab. They sailed away. Amundsen went after Nobile as you might reach out impatiently to take the arm of someone with whom you wished to continue an argument. Somewhere in that cold sea of the North the last of the great Vikings drowned, but for Amundsen there was nothing terrible in death. For him, he often said to his friends, death was but another and a greater exploration.

Orville Wright Told Him—

HE TOLD him the whole story. He let him see secret telegrams. He opened private diaries and personal letters. And out of this opportunity, never before accorded to a writer, John R. McMahon now brings you the true, complete story of the Wright brothers and their invention of the airplane. New incidents and anecdotes of the two immortal brothers and of their struggle to conquer the air are related for the first time in a series of articles more entertaining than fiction, by a writer well known to every reader. You won't want to miss this fascinating story, which begins in next month's issue. Tell your newsdealer now to reserve your copy of POPULAR SCIENCE MONTHLY for January.

THE RED BOMBER COMBAT PLANE FREE!

Positively a sensational offer. Here's the Red Bomber Combat Model Plane, a twin propeller model that flies amazingly. And you can have it free. Boys everywhere are flying model planes. Now is the time to get yours. This sensational plane will fly 600 feet easily, often farther. Wings made of special fibre, two powerful rubber motors, two cleverly fashioned propellers. Not a glider—a real model plane.

Assembled in two minutes

12 Fat Issues

Best of all no tedious hours of toil constructing. This plane can be put together ready to fly by any boy in less than two minutes—positively. Two minutes after the postman delivers your plane, you can send it into the air diving and dipping, zooming, banking, then soaring to greater heights. Every boy will envy you. Order your plane right now!

THRILLING BOY'S MAGAZINE

THE OPEN ROAD for BOYS has 50 pages or more every month crammed with stories of aviation, sport, ranch life, high adventure on land and sea, mystery and daring. Great serial stories, interesting articles, jokes and humor. International correspondence club, stamp department and THE OPEN ROAD PIONEERS—nation-wide club for boys. Contests galore for all. "Golden Medallion," mystery serial smash now starting—breathless reading!

Regular subscription price to The Open Road for Boys is $1 per year. We will send you the Red Bomber Combat Model Plane and a subscription for a whole year—12 fat issues—both for $1. Send the coupon now.

BOTH FOR ONLY $1

Pilot Johnson, Open Road for Boy's Magazine, 138 Newbury St., Boston, Mass.

Friend:
By all means I will grab this offer. Enclosed is $1. Please rush me the Red Bomber Combat Model Plane. Enter my name to receive a year's subscription—12 issues—to The Open Road for Boy's Magazine beginning with the very next number.

Name .....
Street .....
Town or City ..... State .....

You'll Get a pleasant Surprise

BE A RAILWAY TRAFFIC INSPECTOR

DO YOU WANT TO EARN A REAL SALARY?

If you are a normal man over 18 ...

STANDARD BUSINESS TRAINING INSTITUTE
Div. 1 Buffalo, New York

Be an Electrical-Mechanical Auto Expert

Buy goodbye to low pay. Get into the Auto Business, where big pay—extra money—rapid promotion come quick! A brilliant future awaits you in the World's Biggest Business! Earn up to $100 a Week

Send coupon for Free Auto Book! See how I train you right at home, in every branch of auto work. Learn how I prepare you, quickly and easily, for the Big Jobs paying up to $100 a week—and more!

Open Auto Shop

My Free Book tells how men make extra money while training, and then go into business with no further capital. It's the Training that counts, and it is complete training that I give you.

Aviation Course

Common School-ing All You Need

Men between 18 and 60 with very little education are becoming Garage Owners, Superintendents, Foremen. Whether you have had years of Auto experience, or never touched a car before, send for this Free Book now. I'll show you the quick way to get in line for real success in the Auto Business!

Get the Facts!

Learn about our Employment Service—Consultation Service. See how I help you get the good Jobs. Send for this remarkable Free book. Clip coupon now!

Learn AT HOME the Cooke "JOB WAY"

FREE! AUTO BOOK

MAIL THIS FOR FREE BOOK

E. W. COOKE
Directing Engineer
Chicago Motor Training Corp.
1916 Sunnyside Ave., Dept. 1288 Chicago

Send at once your FREE Book, "Auto Facts," full particulars of "Job-Way" Training. No obligation on my part whatever.

Name .....
Address .....

TRAVEL FOR "UNCLE SAM"

Railway Postal Clerks

Steady Work — No Layoffs — Paid Vacations
Many Other Government Jobs Obtainable
MEN—WOMEN 18 to 50

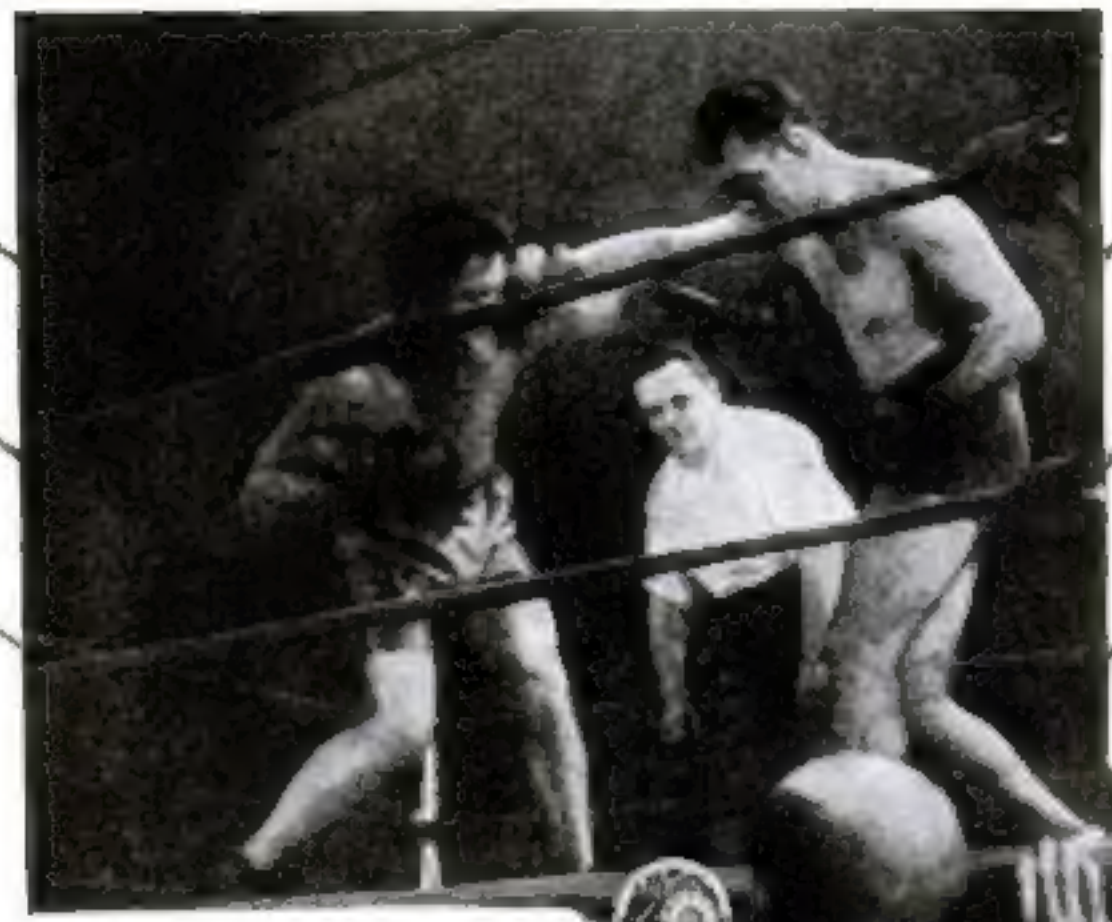
$158 to $225 a Month

MAIL COUPON BEFORE YOU LOSE IT

FRANKLIN INSTITUTE, Dept. J 272
Rochester, N. Y.

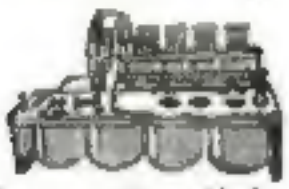
Sirs: Rush to me without charge—copy of 32-page book, "How to Get U. S. Government Jobs," with sample coaching, lists of positions obtainable and full particulars telling how to get a position.

Name .....
Address .....



As if you had a ringside seat

TWENTY-TWO thousand fight fans pack the Garden to see the big fight with their own eyes. . . Millions sitting comfortably at home "see" it from the ringside seat of the radio announcer.



They learn about each telling blow almost as quickly, and much more accurately, than most of the fans seated in the Garden. They hear the thud of glove on body, the muffled thumps of the fighters' dancing feet.

The tense voice of the announcer comes over the air clearly and distinctly, free from interference and without buzz or hum to blur the reception.

That is the experience of the millions whose receiving sets are Aluminum equipped.

No other metal compares with Aluminum in fulfilling all the varied requirements of radio design: for shielding, condenser blades and frames, chasses, sub-panels, front panels and for many other parts.

Look for Aluminum—you will find it in the finest of receiving sets. And if you are building a set, use Aluminum for the best results.

The booklet, "Aluminum for Radio," will be sent on request. It explains the varied radio uses to which Aluminum is adapted. Send for your copy.

ALUMINUM COMPANY OF AMERICA

ALUMINUM IN EVERY COMMERCIAL FORM

2438 Oliver Building Pittsburgh, Pa.

ALUMINUM

The mark of Quality in Radio

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Copyrighted material

For Everlasting Satisfaction

Plug-in with Bremer-Tully

B-T 8-21

B-T 7-71

RADIO

THERE is pleasure in knowing you have the best.

There is satisfaction in knowing that B-T radio will cost you less in the end—it can't help but give you greater enjoyment in the meantime.

It incorporates every worth-while refinement known to science. It is backed by years of constant research and manufacturing experience.

For real dollar for dollar value Bremer-Tully Radio cannot be excelled.

The Choice of Experts

ENGINEERING superiority and exceptional workmanship have marked every Bremer-Tully product for seven years.

Quality dealers everywhere will confirm that statement. They will tell you also that with B-T, "radio quality" always comes first—but you can see that at a glance.

Furniture design and finish that has set a new standard in cabinet design—performance that will give you a new conception of what radio should be.

There is a quality dealer near you who handles B-T radio.

For further information send the coupon.

Time Tried and Time Proved

B-T 6-41

Six, seven and eight tube sets in console or table models provide a choice wide enough for anyone wanting the greatest return on his well-spent dollar.

COUPON

Name _____

Street and Number _____

City _____ State _____

Dealer ☐ User ☐ Builder ☐

PS-12

Bremer-Tully Mfg. Company

656 Washington Boulevard

CHICAGO, ILL.

H A V E A C A M E L

Here come the winners
—they smoke for pleasure

What's the score? Have a Camel. You win the real enjoyment of smoking. Fragrant, mild, altogether delightful—

Camels

"I'd walk a mile for a Camel"

© 1928, R. J. Reynolds Tobacco Company, Winston-Salem, N. C.